FISHERY RESEARCH

IDAHO SUPPLEMENTATION STUDIES

Brood Year 2010 Synthesis Report

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Brood Year 2010 Synthesis Report
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ABBREVIATIONS AND ACRONYMS

Acronym	Definition	Acronym	Definition
BPA	Bonneville Power Administration	mm	Millimeter
C	Control	MUI	Multiple use PIT tag injector
cm	Centimeter	n	Number
cfs	Cubic feet per second	ND	No Data
CRITFC	Columbia River Intertribal Fisheries Commission	NOAAF	National Oceanic and Atmospheric Administration Fisheries
CWT	Coded Wire Tag	NPTM	Nez Perce Tribe, McCall Office
d	Days	NR	Nampa Research
DIDSON	Dual Frequency Identification Sonar	PIT	Passive Integrated Transponder
DNA	Deoxyribonucleic acid	PTAGIS	PIT Tag Information System
EFGL	Eagle Fish Genetics Laboratory	SE	Standard Error
F	Female	SUI	Single use PIT tag injector
FL	Fork Length	SURPH	Survival Under Proportional Hazards model
GP	General Production (hatchery)	T	Treatment
IFRO	Idaho Fisheries Resource Office	U	Undetermined
ISRP	Independent Scientific Review Panel	UCI	Upper Confidence Interval
km	Kilometer	VSP	Viable Salmonid Population
LCI	Lower Confidence Interval	WFYF	West Fork Yankee Fork Salmon River
m	Meter		
M	Male		

ABSTRACT

The Idaho Supplementation Studies (ISS) project was implemented in 1992 to evaluate the benefits and risks of using hatchery supplementation to increase natural production of spring/summer Chinook salmon *Oncorhynchus tshawytscha*. This report documents ISS research tasks completed by the four cooperating agencies (Idaho Department of Fish and Game, Nez Perce Tribe, Shoshone-Bannock Tribes, and U.S. Fish and Wildlife Service). We present a summary of all activities associated with brood year 2010 Chinook salmon in ISS study streams including data on the number of adults that returned to collection facilities (escapement), adults passed onto spawning grounds (adult treatments), juvenile releases in three streams, redd counts, and carcass information. The report then follows the resulting juveniles through migration, including natural production estimates and survival to Lower Granite Dam. Beginning with brood year 2008 the ISS project entered its final phase of evaluating post supplementation population responses. The last supplementation adults returned in 2007, therefore no further data are available for this group. The number of natural origin adults passed over weirs in 2010 ranged from seven to 38 fish in the Clearwater River subbasin and from 274 to 1,343 fish in the Salmon River subbasin. Redd density in survey transects in the Clearwater River subbasin streams averaged 2.4 redds/km. Salmon River subbasin streams averaged 4.8 redds/km. Carcass data were collected concurrently with redd counts. We collected 3,391 carcasses in 2010. We estimated 2,434,855 brood year 2010 natural origin juvenile Chinook salmon emigrated from 15 ISS streams with screw traps. Survival to Lower Granite Dam was similar to previous years, with age-1 smolt survival averaging 42% and summer and fall emigrant survival averaging 16% and 20%, respectively.

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INTRODUCTION

Background

The Idaho Supplementation Studies (ISS) is a cooperative research project involving the Idaho Department of Fish and Game (IDFG), the Nez Perce Tribe (NPT), the Shoshone-Bannock Tribes (SBT), and the United States Fish and Wildlife Service (USFWS), and is funded by the Bonneville Power Administration (BPA). Each agency is responsible for data collection on a subset of study streams across the Clearwater and Salmon river subbasins as developed in the original study design (Bowles and Leitzinger 1991). Beginning with brood year 2008 the ISS project entered its final phase of evaluating post supplementation population responses. The last supplementation adults returned in 2007, therefore no further data are available for them. Data collected include estimates of escapement for natural origin adult Chinook salmon *Oncorhynchus tshawytscha*, biological data from salmon carcasses, juvenile production in treatment and control streams, juvenile passive integrated transponder (PIT) tag interrogations at detection facilities throughout the Columbia River basin, and stray rates of general production hatchery adults into study streams.

The ISS study addresses critical uncertainties associated with hatchery supplementation of Chinook salmon populations (i.e., effects on productivity, persistence, establishment, and advantages of localized broodstocks) in Idaho (Bowles and Leitzinger 1991). The ISS program also addresses questions identified in the Supplementation Technical Work Group Five Year Work Plan (STWG 1988), defines the potential role of supplementation in managing Snake River basin anadromous fisheries, and evaluates its usefulness as a recovery tool for salmon populations in the Snake River basin (Bowles and Leitzinger 1991).

The ISS program initially identified two goals in the Salmon and Clearwater subbasins: 1) assess the use of hatchery Chinook salmon to increase natural populations, and 2) evaluate the genetic and ecological impacts of hatchery Chinook salmon on naturally reproducing Chinook salmon populations. In response to these goals, ISS addresses four objectives: 1) monitor and evaluate the effects of supplementation on presmolt and smolt numbers and spawning escapement of naturally produced Chinook salmon; 2) monitor and evaluate changes in the productivity and genetic composition of naturally spawning target and adjacent populations following supplementation activities; 3) determine which supplementation strategies (broodstock and release stage) provide the most rapid and successful response in natural production without adverse effects on productivity; and 4) develop supplementation recommendations (Bowles and Leitzinger 1991).

This document summarizes activities conducted by ISS cooperators and data collected between 2010 and 2012 on Chinook salmon that spawned in 2010 (brood year 2010) and their resulting progeny. Our summary includes data on the number of adults that returned to collection facilities, redd counts, and carcass information. The report then provides information on the resulting juveniles through migration, including natural production estimates and survival to Lower Granite Dam. Summaries and estimates contained herein are preliminary. Adult data are from natural origin and general production strays. Additionally, we provide preliminary data on adult returns for 2011 (Appendix A) and 2012 (Appendix B). Beginning with the report covering brood year 2002 activities (Venditti et al. 2005), the ISS now produces a single, synthesis report each year based on the brood year activities instead of individual agency reports covering either brood or calendar years.

Study Area

The ISS program incorporates treatment and control streams in the Clearwater River and Salmon River subbasins. Currently, 14 treatment and 13 control streams are included in ISS. The Clearwater River subbasin contains eight treatment and four control streams. The Salmon River subbasin includes six treatment and eight control streams (Figure 1).

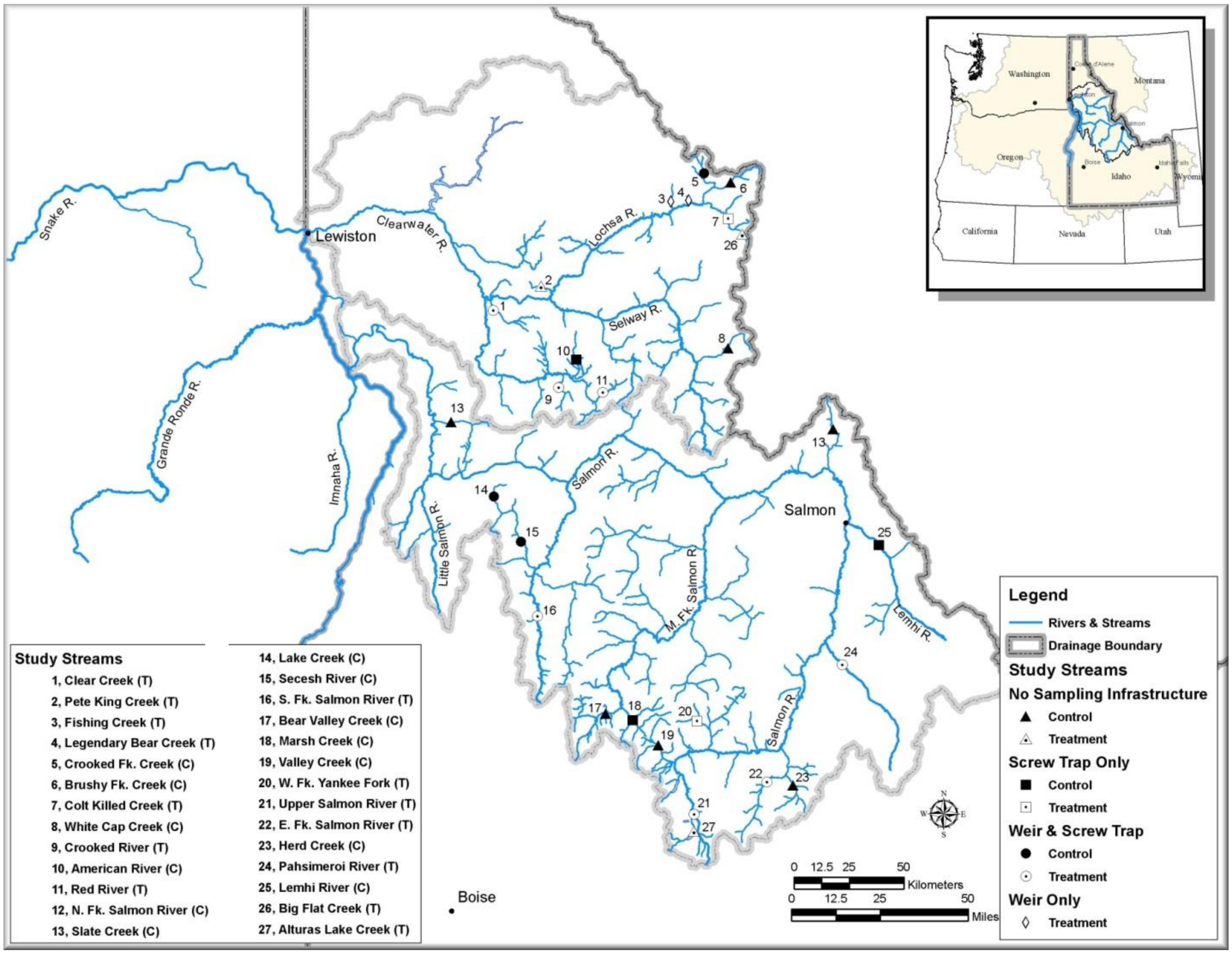

Figure 1. Current treatment and control streams in the Salmon River and Clearwater River subbasins monitored by the four agencies participating in the Idaho Supplementation Studies. Cooperators include the Idaho Department of Fish and Game, Nez Perce Tribe, Shoshone-Bannock Tribes, and the U.S. Fish and Wildlife Service. Legendary Bear and Fishing creeks are revised names for Papoose Creek and Squaw Creek, respectively.

Supplementation activities will continue in Johnson, Newsome, and Lolo/Eldorado creeks through other programs. Because the protocols used there do not contribute to ISS in phase three, the last year we reported data from these streams was in the brood year 2008 report (Venditti et al. 2012). Data from the Johnson Creek Artificial Propagation and Evaluation Program (Project Number 1996-043-00) and Nez Perce Tribal Hatchery Monitoring and

Evaluation Program (Project Number 1983-350-003) for Lolo and Newsome creeks will be available for analyses as recommended by the ISRP (ISRP 2003-8).

Fish communities are similar across all ISS study streams. Anadromous species in all streams include wild/natural (hereafter natural) and hatchery Chinook salmon, summer-run steelhead *O. mykiss*, and Pacific lamprey *Entosphenus tridentatus*. Sockeye salmon *O. nerka* are present in the upper Salmon River. Resident fish communities for the Clearwater and Salmon river subbasins include bull trout *Salvelinus confluentus*, westslope cutthroat trout *O. clarkii lewisi*, mountain whitefish *Prosopium williamsoni*, redside shiner *Richardsonius balteatus*, northern pikeminnow *Ptychocheilus oregonensis*, sculpin *Cottus* spp., dace *Rhinichthys* spp., suckers *Catostomus* spp., resident redband rainbow trout *O. mykiss*, and eastern brook trout *S. fontinalis* (Bowles and Leitzinger 1991). However, not all species inhabit all streams.

METHODS

Adult Escapement

Weirs

Where possible, we used adult weirs to capture, enumerate, and manage adult Chinook salmon entering ISS study streams. Evaluation of escapement into streams without weirs was limited to spawning ground surveys and carcass recoveries. In the Clearwater subbasin, we operated adult weirs on Crooked River, Red River, Crooked Fork Creek, and Clear Creek (Figure 1; sites 9, 11, 5, 1). In the Salmon subbasin, weirs were located on the South Fork Salmon River, Pahsimeroi River, upper Salmon River, and East Fork Salmon River (Figure 1; sites 16, 24, 21, 22). All natural origin adults were passed above weirs to spawn. At most locations, adults passed above weirs were marked with an operculum punch to allow mark/recapture escapement estimates from carcass recovery data. We transported general production hatchery Chinook salmon intercepted at weirs to the hatchery or recycled them into an ongoing fishery downstream of ISS evaluation reaches. In addition to enumeration, we recorded fork length (FL), sex, external tags, marks, and fin clips. We collected DNA samples from the fins of all adults passed above weirs. We used the ratio of marked (opercle punch) to unmarked carcasses in surveys to estimate total spawning escapement with a simple Peterson mark–recapture estimator (Everhart and Youngs 1981).

We operated two passive weirs in the Secesh River drainage during 2010. The ISS project took over the operation of a video weir on Lake Creek in 2007 and continued to operate it through this reporting period. The video weir was located at the mouth of Lake Creek (Figure 1; site 14). The design of the weir allowed fish to pass freely through the weir and in front of a video camera, which recorded fish passages in both directions on videotape. From these tapes, program personnel enumerated fish passages, identified fish to species, and examined fish images for fin clips or other marks. The 24-hour video footage throughout the season provided an estimate of fish that moved into Lake Creek. The Chinook Salmon Adult Abundance Monitoring Project (BPA Project No. 199703000) continued the operation of an acoustic imaging (dual frequency identification sonar or DIDSON) and video recorder in the Secesh River (Kucera 2011) at river kilometer 30.0 (Figure 1; site 15). The design of the structure allowed fish to pass freely past the sonar array. Program personnel enumerated fish passages and measured fish lengths from the DIDSON files. The files recorded all fish passages in both directions, providing an estimate of fish that moved into the Secesh River, and the video camera provided validation for the DIDSON data (Kucera 2011).

Redd Counts

Chinook salmon redds were counted in all study streams from July through September to estimate spawning escapement. Since precise measures of production are critical to ISS evaluation, we maintained index reaches as reported in Walters et al. (1999) as well as expanding survey reaches to include all probable spawning habitat. Most reaches were surveyed three or more times with ground counts following standard procedures outlined in IDFG's Redd Count Manual (Hassemer 1993). Multiple ground counts allow observation either during redd construction or shortly thereafter and aid in redd identification. Multiple counts also increase the number of adult Chinook salmon carcasses recovered over what would have been collected in a single count design. Exceptions included Big Flat and Colt Killed creeks (Figure 1; sites 26 and 7), which are remote streams where access is difficult. We surveyed these streams once with a single pass ground count that, based on historic spawn timing, we believe coincided with peak spawning activity. Prior to 2010 our protocol had been to survey Alturas Lake Creek and White Cap Creek (Figure 1; sites 27 and 8, respectively) once with an aerial count, and a combination of aerial and ground counts were used for redd surveys on the Lemhi and upper Salmon rivers (Figure 1; sites 25, 21). In response to a helicopter accident near the beginning of aerial redd counts in 2010, surveys in White Cap and Alturas Lake creeks and the upper Salmon and Lemhi rivers were done by ground count.

Redds observed during ground counts were flagged, assigned a unique number, and recorded using a global positioning system. Surveyors recorded the presence of any adult Chinook salmon observed. For streams that received multiple ground counts, the final redd count was the sum of all new redds observed in each pass. We removed our flags during the last count.

Carcass Recoveries

We collected data from Chinook salmon carcasses to determine their origin (general production hatchery or natural), ocean age, spawning status, sex, and fish health. Measurements collected included FL and mid-eye to hypural plate length (nearest cm). We checked carcasses for fin clips, marks, tags, radio transmitters, and/or coded-wire tags (CWT). We collected dorsal fin rays (Kiefer et al. 2002) and scales for age determination and fin tissue for DNA analysis. Otoliths were collected in Middle Fork Salmon River tributaries. Structures collected varied by stream, and we did not collect all structures from all carcasses. We inspected visceral cavities to estimate egg retention, to look for PIT tags (most observers also used PIT tag detectors), and to determine the prevalence of prespawn mortality. During examination, female carcasses were given a percent spawned measure that ranged from zero (skeins fully intact) to 100% (no or few eggs remaining in body) in 25% increments. We considered female carcasses with a percent spawn value ≤25% a prespawn mortality. All male carcasses recovered prior to observance of any spawning activity were designated prespawn mortalities. After spawning commenced, we did not evaluate male carcasses for spawning contribution. Finally, on the upper Salmon River (above Sawtooth Hatchery) and Pahsimeroi River, we collected kidney and spleen tissues for monitoring viral and bacterial pathogens.

Prespawn mortality occurs in all spawning streams and is influenced by such factors as stream flow, water temperature, natural predators, fish density, and crowding and handling at adult traps. During recent years, sport and tribal fisheries likely added an additional stressor. Beginning the first week of July, prior to the commencement of spawning activities, we surveyed all probable spawning areas in Lake Creek twice a week to locate prespawn carcasses, and we surveyed known staging areas in the South Fork Salmon River beginning in mid-July.

Juvenile Production

We based life stages used in production estimates on age, biological development, and arbitrary seasonal trapping dates. Newly emerged, young-of-the-year juveniles captured prior to July 1 (spring trapping season) were considered fry. Fry became “parr” as they entered their first summer and included age-0 fish collected between July 1 and August 31 (summer trapping season) as they migrated from natal streams. Presmolts were juvenile fish that were collected moving downstream between September 1 and trap removal at ice-up (fall trapping season). Although we defined juveniles in the act of migration before September 1 as parr in this report, they could also be considered presmolts. Migrating presmolts did not show typical smolt characteristics (e.g., silvery color and the tendency to lose their scales easily). Smolts were generally age-1 migrants captured between the start of spring trapping and June 30. However, a portion of the age-0 juveniles PIT tagged in the Lemhi and Pahsimeroi rivers (Figure 1; sites 25, and 24) during the spring trapping period were interrogated at detection facilities on the Lower Snake and Columbia rivers in that same year and were actually age-0 smolts (Copeland and Venditti 2009).

Rotary Screw Trap Estimates

We operated rotary screw traps on 15 streams to collect juvenile Chinook salmon migrating downstream to estimate cohort abundance and survival to Lower Granite Dam as well as important life history information, such as size at migration and the timing of peak movements. We deployed traps as early in the spring as possible and fished them continuously until ice-up in the fall. We positioned the screw traps in the thalweg to maximize capture efficiency. Program personnel checked traps and processed fish at least once daily between 0700 hours and 1830 hours. However, high flows, debris, and ice prevented trap operation on some days. When we anticipated problems (e.g., high flows, ice, or debris) or when unusually high numbers of juveniles were passing (generally immediately following hatchery releases) we checked the traps several times throughout the day and night as necessary. We may have also moved traps out of the thalweg and/or stopped fishing them (i.e., raised the cone) during those times until it was prudent to resume fishing.

The Clear Creek screw trap had been located immediately below the Kooskia Hatchery intake. Renovations to the intake rendered the site unusable. In response, the trap was relocated approximately 1 km downstream in 2011.

We processed juvenile Chinook salmon collected in screw traps using standard protocols. Captured fish were anesthetized in buffered Tricaine Methanesulfonate (MS-222), scanned for PIT tags, weighed (to nearest 0.1 g), and measured to the nearest 1 mm FL. We anesthetized no more than 30 juvenile fish at one time to reduce exposure time to the anesthetic. A subsample of fish was marked with standard length PIT tags (see below) to estimate trap efficiency and survival to Lower Granite Dam. In some streams, a large percentage of juveniles were too small to be PIT tagged. In these streams, juveniles were marked with Bismarck Brown dye (described below) to estimate trap efficiency. Fish needed to be ≥60 mm FL to be PIT tagged with a 12 mm tag or ≥35 mm FL to be dyed. A number of Chinook salmon ≥50 mm FL were tagged with 8.5 or 9 mm PIT tags, and these data will be reported separately to maintain consistency with past ISS protocols. PIT tagging protocols followed procedures described by Kiefer and Forster (1991) and the PIT Tag Steering Committee (1992). We sterilized PIT tagging needles and PIT tags in a 70% to 100% ethanol solution for 10 min prior to and between uses. After tagging and prior to release, we allowed fish to recover in large, lidded plastic boxes with sufficient free flow of water or in buckets of water with aeration and temperature control.

To estimate the efficiency of our traps, we released a subsample of marked fish approximately 0.4 km or at least two riffles and a pool upstream of the trap. We selected release sites to maximize the probability that marked fish would mix randomly with the general population prior to their recapture. We made trap efficiency releases daily using PIT-tagged fish and every 3-4 d when staining fry. The number of fish used in these releases was based on a predetermined percentage of the daily catch designed to distribute PIT tags proportionally over the entire trapping season and the maximum number of fry that could be effectively stained. We held all other fish in separate live boxes and released them downstream of the trap. In streams with a high abundance of predators, we released fish after dusk. We held fish no longer than necessary to reduce negative effects on their migration.

We calculated life stage (i.e., parr, presmolt, and smolt) specific migration (or population) estimates within the brood year from rotary screw trap operations with a computer program developed for use with screw trap data (Steinhorst et al. 2004). The program needs three inputs: the number of unmarked fish trapped (Capture); the number of captured fish marked and released upstream of the trap (Mark); and the number of marked fish recaptured (Recapture). The program uses the Lincoln-Petersen estimator and modifications (e.g., Bailey's estimator) for calculating abundance and bootstrap methods for calculating confidence intervals (Steinhorst et al. 2004; Hong 2002). We divided each trap season into periods of varying length corresponding to our life stage definitions above (i.e., fry, parr, presmolt, and smolt). Trap efficiency was monitored to detect changes relative to environmental conditions (e.g., flow and temperature), and efficiency strata were established within the periods based on these conditions. This resulted in an improvement in overall efficiency estimation and, therefore, tighter bounds on migration estimates. To maintain robustness for analysis, we set a lower limit of seven mark recaptures for any strata (Steinhorst et al. 2004). If a stratum did not contain a sufficient number of recaptures, it was included with the previous or subsequent strata depending on stream and trap conditions. Young-of-the-year Chinook salmon fry were not included in smolt estimates for the spring season. Likewise, we did not include precocial Chinook salmon in brood year estimates for parr, presmolt, or smolt emigrants. We did not estimate precocial Chinook salmon emigrants because we could not estimate trapping efficiency for this group, which likely differed from other PIT-tagged migrants.

Bismarck Brown Stain Marking—Fry <60 mm represent a large fraction of the total juvenile migration from some study streams, and we used Bismarck Brown stain to conduct a complementary mark-recapture migration estimate that included fish too small to PIT tag. Once or twice a week, we selected a subsample of 10% of the total trap catch (up to a maximum of 300 individuals) for staining. We applied the mark by holding fish in the dye (0.4g/16 L solution) for 1 h. We used four battery-powered aerators to maintain oxygen saturation and ice packs to maintain an appropriate temperature (within 1-2°C of the river) in the baths. When properly stained, the mark lasted 3-4 d, but changing the dye concentration and/or exposure time provided some ability to adjust the mark's effective lifespan.

We derived abundance or migration estimates from Bismarck Brown stained fish using the same techniques as described for PIT-tagged fish, with the exception that marked fish were identified visually instead of via a scanner. To better detect stained fish, personnel removed no more than 10 fish in any one net load from the trap box and placed them in a shallow, white tub of water where stained fish were readily identifiable.

Snorkel Estimates

We used underwater observations by snorkelers in a number of ISS study streams to estimate the density of juvenile Chinook salmon because of a lack of available screw traps, access issues, and limited potential trap locations. Techniques and rationale used during underwater observations to determine Chinook salmon parr abundance and density follow Thurow (1994), Petrosky and Holubetz (1985), Hankin (1986), and Hankin and Reeves (1988).

Streams were divided into sampling strata based on channel and habitat types and areas that Chinook salmon historically used for rearing. Channel types included confined, steep gradient reaches (Type B) and lower gradient, meandering reaches (Type C) (Rosgen 1985, 1994). We also identified four habitat types: pool, riffle, run, and pocket water. Pool, riffle, and run (glide) correspond to the definitions of Bisson et al. (1982). Pocket water was predominantly swift with numerous protruding boulders or other large obstructions, which create scour holes (pockets) or eddies (McCain et al. 1990). We established multiple sample sites in each stratum. Each sample site included one or more habitat types confined at both the upper and lower borders by a hydraulic control (Platts et al. 1983; McCain et al. 1990).

We performed snorkel surveys during July and August. To ensure adequate light, we made observations between 1000 and 1800 hours on non-overcast days. We measured underwater visibility prior to snorkeling, and then used enough snorkelers to observe the entire stream width in one pass. We identified and counted all salmonids and estimated their total length. We also recorded the presence of non-salmonids. We measured the thalweg length of each snorkel site along with three wetted stream widths (top, near midpoint, and bottom of transect). We then estimated Chinook salmon parr density (number per 100 m^2) for each snorkel site by dividing the total number of parr observed by the total area snorkeled and then multiplying the result by 100.

Juvenile Migration and Survival

Comparison of Tag Injector Types

Single-use PIT tag injectors (SUI) recently became available, with claims of decreasing shed rates, mortality, and personnel cost (S. McCutcheon, 2011 PSMFC PIT tag workshop presentation, http://www.ptoccentral.org/Workshop_2011/2011_PIT_Tag_Workshop.pdf). We have always followed the Columbia basinwide protocols for tagging with multiple-use injectors (MUI) fixed with needles that are sterilized in non-denatured ethanol between uses; and loose tags that are also sterilized before insertion into fish (CBFWA 1999). Needles are discarded as they become dull, making ragged incisions in fish. Some cooperators wished to switch to the SUI at ISS screw traps. However, we were concerned that if claims of differential survival were true, we would introduce another confounding factor in the multiple year and multiple population juvenile emigrant and smolt survival comparisons that are at the core of ISS results. We decided to conduct a side-by-side test of performance of fish tagged with the two methods. The experiment was conducted in streams that, in recent years, have taggable populations large enough that we could maintain our long-term dataset of emigrant and survival estimates using only the portion of fish tagged with the standard MUI, if we did observe a difference between tagging methods. We chose three ISS screw traps: Marsh Creek, upper South Fork Salmon River, and Crooked Fork Creek and one trap operated by the Idaho Steelhead Monitoring and Evaluation Studies (ISMES; Project Number 1990-055-00) in lower Big Creek, tributary to the Middle Fork Salmon River. Additionally, we traced the costs of materials and supplies associated with each method at two traps (South Fork Salmon River and Big Creek) for comparison.

For all brood year 2010 Chinook salmon captured in the selected screw traps (July 1, 2011 through June 30, 2012) we alternated tagging method each day. With this approach, both groups contained approximately the same number, size, and proportion of juveniles with similar emigration timing. Alternating days also ensured that both groups experienced the same river conditions, and tagger effects (which we did not evaluate) were spread evenly over both methods. We extended the test to steelhead parr and smolts tagged at the traps for ISMES during this time period. With exception of the type of tag injector used, all fish were handled consistently with standard protocols outlined above. Tagging method (SUI vs. MUI) was associated with each PIT tag record in text comments for ease of query from the PTAGIS database.

We generated separate survival estimates to LGR for the two groups of juveniles tagged with the SUI vs. MUI methods at each of the four screw traps in the study described previously. If the 95% CI's generated by the SURPH Model did not overlap for the two tagging methods, we would report estimates from fish tagged using MUI to maintain consistency and comparability with previous ISS survival estimates. However, if no differences were found, both groups would be pooled. We limited our analysis to include only the paired life stage groups from within a location (e.g., SUI smolt survival from Big Creek was only compared to MUI smolt survival from Big Creek).

Screw Trap Estimates

We estimated the survival of PIT-tagged juveniles to LGR using PIT tag interrogations at dams on the Snake and Columbia rivers and the Survival Under Proportional Hazards (SURPH) model (Lady et al. 2001). Juveniles from the Lemhi and Pahsimeroi rivers display both stream- and ocean-type life histories (Healey 1991), but the number of age-0 smolts from the Lemhi are typically too few to estimate survival and are included with parr. We report survival estimates separately for both groups from the Pahsimeroi River (age-0 and age-1 smolts) within a brood year.

Summer Parr Remote PIT Tagging

We collected natural origin parr and PIT tagged them in some ISS streams. IDFG and NPT Fisheries personnel snorkeled to determine where juveniles were concentrated, and then collected them via beach seine. Bowles and Leitzinger (1991) recommended a target goal of 300-500 parr for PIT tagging. We began using 8.5 mm PIT tags (instead of standard 12 mm tags) in fish from Legendary Bear and Fishing creeks in 2009. We made this change because fish in these streams are typically so small it required an inordinate amount of time to collect sufficient numbers of fish ≥60 mm FL.

<u>Genetic Sample Inventory</u>

As part of the ISS program, we collected both adult and juvenile DNA samples from various traps and weirs for multiple purposes. Individual samples include tissue removed from fins stored in 100% non-denatured ethyl alcohol or on blotter paper. We sampled every adult passed over weirs, adults from carcass surveys not sampled at weirs, and approximately 100 juveniles from each brood year. Samples have been used to compare the reproductive contribution of natural and supplementation-hatchery origin adults (Leth 2005) and to contribute to the genetic baseline for genetic stock identification of Chinook salmon adults passing Lower Granite Dam (Narum et al. 2007). The importance of collecting and archiving DNA from a variety of ISS study streams for current and future analyses have been acknowledged by the Independent Scientific Review Panel (ISRP), which recommended we continue to collect and archive tissue samples (ISRP 2005-18, ISRP 2006-4B). In order to better manage the growing archive of DNA, we have compiled an inventory of the DNA samples the program currently maintains (Appendix E). We will update this inventory annually.

Data Storage

Data from the ISS program is available through several sources. Redd count and carcass data are available through StreamNet (http://www.streamnet.org) and Idaho Fish and Wildlife Information System (IFWIS; https://fishandgame.idaho.gov/ifwis/portal). Adult and juvenile PIT tag data are available through the PTAGIS database (http://www.ptagis.org). Coded wire tag data are available through the Regional Mark Processing Center (http://www.rmpc.org). Other data types are maintained in project and agency specific databases and spreadsheets. These data are available from the authors.

Beginning in 2010, the ISS program began operating a second screw trap on Marsh Creek and conducting additional redd counts in streams above this trap. Data from these efforts are not part of the ISS study but are used for regional viable salmonid population (VSP) monitoring efforts (Crawford and Rumsey 2011). The trap is located approximately 1 km downstream from the confluence of Marsh and Beaver creeks. Additional multiple pass redd counts have been initiated in Cape Horn, Beaver, Banner, and Marsh creeks that along with traditional ISS counts in Marsh and Knapp creeks will provide high intensity (fish-in fish-out) monitoring data for this population. Until data storage and reporting procedures are established for the VSP efforts, we will provide trap and redd count results in ISS annual reports (Appendix F). We will also provide these data to electronic repositories as described above.

RESULTS

Adult Escapement

Weirs

The number of adult Chinook salmon that escaped to weirs varied among study streams and basins in 2010. Returns of general production and natural origin fish were generally lower in the Clearwater River subbasin and ranged from 130 fish in Crooked Fork Creek to 807 fish in Clear Creek. Returns to weirs in the Salmon River subbasin ranged from 275 fish in the East Fork Salmon River to 7,737 fish at the South Fork Salmon River weir (Table 1). Except for Lake Creek, these numbers are only the counts of fish handled and do not represent total escapement above the weirs. The video weir on Lake Creek experienced less than 2 days of down time in 2010, so we believe this represents an accurate estimate of the number of adults that escaped to this stream.

Of the fish captured at ISS weirs, we passed 3,240 natural-origin adult Chinook salmon (99.8% of capture) onto the spawning grounds in 2010. These ranged from seven (Clear Creek) to 38 (Red River) fish in the Clearwater River subbasin and from 274 (East Fork Salmon River) to 1,343 (South Fork Salmon River) fish in the Salmon River subbasin (Table 2).

Table 1. The number, origin, and sex (male = M, female = F, and undetermined = U) of adult Chinook salmon captured or counted at weirs on Idaho Supplementation Study (ISS) streams in 2010. Catch numbers are not expanded and do not represent total escapement. General production adults were generally not passed over the weirs, but see Appendix C.

	General production			Natural			Undetermined			
Stream Name	**M**	**F**	**U**	**M**	**F**	**U**	**M**	**F**	**U**	**Total**
Clearwater River Subbasin										
Clear Creek	120	206	474	3	3	1	0	0	0	807
Crooked Fork Creek	60	46	0	20	4	0	0	0	0	130
Crooked River	0	0	505	13	6	12	0	0	0	536
Red River	0	0	462	21	2	15	0	0	0	500
Salmon River Subbasin										
Lake Creek										508
Pahsimeroi River	3,302	3,895	0	179	113	1	0	0	0	7,490
South Fork Salmon River	3,029	3,359	0	854	494	0	1	0	0	7,737
East Fork Salmon River	0	0	1	202	72	0	0	0	0	275
Upper Salmon River	403	349	0	546	177	0	0	0	0	1,475

Table 2. Summary of adult Chinook salmon passed above weirs as adult treatments to Idaho Supplementation Study (ISS) streams in 2010. Treatments are broken down by sex (male = M, female = F, and undetermined = U) and origin. Release numbers are not expanded and do not represent total escapement.

	Natural			General production			
	M	**F**	**U**	**M**	**F**	**U**	**Total**
Clearwater Subbasin							
Clear Creek	3	3	1	0	0	0	7
Crooked Fork Creek	20	4	0	0	0	0	24
Crooked River	13	6	12	0	0	0	31
Red River	21	2	15	0	0	0	38
Salmon Subbasin							
Lake Creek							508
Pahsimeroi River	179	113	0	0	0	0	292
S. F. Salmon River	849	494	0	0	0	0	1,343
E. F. Salmon River	202	72	0	0	0	0	274
Upper Salmon River	546	177	0	0	0	0	723

The expanded estimates of total spawning escapement above weirs where mark recapture data were collected (Appendix C) indicated that ISS weirs had a wide range of efficiency in 2010. The South Fork Salmon River and upper Salmon River weirs were >90% efficient (>90% of recovered carcasses were marked), and the Pahsimeroi Hatchery weir was approximately 87% efficient. Conversely, the number of unmarked carcasses recovered above the Clear and Crooked Fork creek weirs outnumbered marked carcasses (no marked carcasses were recovered in either stream in 2010, so weir efficiency could not be estimated).

Redd Counts and Carcass Recoveries

The number of redds varied between streams in 2010, but redd densities (redds/km) were about twice as high in the Salmon subbasin than the Clearwater subbasin. Redd density in the Clearwater River basin averaged 2.36 redds/km, while those in the Salmon River basin averaged 4.80 redds/km. In the Clearwater basin, Clear Creek had the highest redd density (7.80 redds/km), and Pete King and Big Flat creeks (zero redds/km) had the lowest (Table 3). Salmon River basin redd densities were highest in the South Fork Salmon River (15.41 redds/km), and lowest in the West Fork Yankee Fork Salmon River (0.69 redds/km; Table 3).

Table 3. Number of Chinook salmon redds counted in survey transects within Idaho Supplementation Study (ISS) streams in 2010 and summary information on transect length, number of passes, method of data collection, and when redd counting effort was stopped. Cases for which no data were available are designated ND.

Stream	Survey length (km)	Redds	Redds per km	Passes	Last pass	Survey method
Clearwater Subbasin						
American R.	34.6	133	3.84	3	9/22	Ground
Big Flat Cr.	3.0	0	0	1	9/5	Ground
Brushy Fk. Cr.	16.1	20	1.24	4	9/13	Ground
Clear Cr.	20.2	158	7.8	4	9/13	Ground
Colt Killed Cr.	50.9	25	0.49	1	9/8	Ground
Crooked Fk. Cr.	21.7	94	4.33	4	9/16	Ground
Crooked R.	18.8	13	0.69	3	9/24	Ground
Fishing Cr.	6.0	14	2.33	3	9/09	Ground
Legendary Bear Cr.	6.8	28	4.12	3	9/09	Ground
Pete King Cr.	5.8	0	0	3	9/15	Ground
Red R.	38.5	113	2.94	3	9/23	Ground
White Cap Cr.	12.9	7	0.54	1	9/14	Ground[a]
Salmon Subbasin						
Alturas Lake Cr.	14.0	17	1.21	1	9/12	Ground[a]
Bear Valley Cr.	35.7	227	6.36	3	9/14	Ground
EF Salmon R.	27.0	61[b]	2.26	3	9/15	Ground
Herd Cr.	16.4	37	2.26	3	9/9	Ground
Lake Cr.	16.8	252	15.00	3	9/03	Ground
Lemhi R.	51.7	89	1.72	4/1	9/20	Ground[c]
Marsh Cr.	20.2	145	7.18	7	9/5	Ground
NF Salmon R.	36.8	70	1.90	4	9/10	Ground
Pahsimeroi R.	25.3	81	3.20	4	9/30	Ground
Secesh R.	40.1	310	7.73	3	9/20	Ground
SF Salmon R.	25.3	390	15.41	4	9/8	Ground
W.F. Yankee Fork S.R.	11.6	8[d]	0.69	3	9/7	Ground
Upper Salmon R.	50.3	147	2.92	1	9/12	Ground[a]
Valley Cr.	33.2	90	2.7	3	9/13	Ground
Slate Cr.	15.4	23	1.49	3	9/19	Ground

[a] Traditional aerial surveys conducted via ground survey after a mandatory IDFG grounding of all redd count flights.

[b] A total of 60 redds by natural origin females and 1 redd by captive origin female from Project Number 199700100.

[c] Includes four passes on the standard ISS transects and one pass on the expanded area typically flown. Aerial redd counts were canceled in 2010 after a mandatory IDFG grounding of redd count flights.

[d] A total of 7 redds by natural origin females and 1 redd by captive origin female from Project Number 199700100.

The ISS cooperators maintained the increased carcass sampling effort described in Lutch et al. (2003). We sampled 1,362 carcasses from the Clearwater basin and 2,029 from the Salmon basin totaling 3,391 carcasses in 2010. The total included 2,175, 1,039, and 177 carcasses of natural, general production, and unknown origin, respectively. In the Clearwater basin general production carcasses outnumbered natural origin carcasses in all streams from which carcasses were recovered except Crooked River (Table 4). Conversely, general production strays were uncommon in Salmon basin streams, even those without weirs (Table 4).

Table 4. Number, origin (GP = general production hatchery), and sex of adult Chinook salmon carcasses collected during 2010 spawning ground surveys on Idaho supplementation study (ISS) streams. Streams where redd counts were not conducted in 2010 are designated ND.

Stream	Sex	Unknown	Natural	GP
Clearwater R.				
American R.	Males	10	23	109
	Females	12	28	101
	Unknown	9	11	8
	Total	**31**	**62**	**218**
Big Flat Cr.	Males	0	0	0
	Females	0	0	0
	Unknown	0	0	0
	Total	**0**	**0**	**0**
Brushy Fk. Cr.	Males	0	0	2
	Females	0	1	0
	Unknown	0	0	0
	Total	**0**	**1**	**2**
Clear Cr.	Males	6	10	171
	Females	0	8	98
	Unknown	1	0	0
	Total	**7**	**18**	**269**
Colt Killed Cr.	Males	0	0	0
	Females	0	0	0
	Unknown	0	0	0
	Total	**0**	**0**	**0**
Crooked Fk. Cr.	Males	0	2	13
	Females	0	1	14
	Unknown	0	0	0
	Total	**0**	**3**	**27**
Crooked R.	Males	0	10	1
	Females	0	3	1
	Unknown	0	2	1
	Total	**0**	**15**	**3**
Fishing Cr.	Males	0	0	0
	Females	0	0	1
	Unknown	0	0	0
	Total	**0**	**0**	**1**
Legendary Bear Cr.	Males	0	1	1
	Females	0	3	5
	Unknown	1	0	1
	Total	**1**	**4**	**7**

Table 4. Continued.

Stream	Sex	Unknown	Natural	GP
Pete King Cr.	Males	0	0	0
	Females	0	0	0
	Unknown	0	0	0
	Total	**0**	**0**	**0**
Red R.	Males	11	30	237
	Females	13	26	212
	Unknown	83	45	36
	Total	**107**	**101**	**485**
Salmon R.				
Bear Valley Cr.	Males	0	65	0
	Females	0	61	0
	Unknown	0	26	0
	Total	**0**	**152**	**0**
EF Salmon R.	Males	0	25	0
	Females	0	19	1
	Unknown	0	1	0
	Total	**0**	**45**	**1**
Herd Cr.	Males	0	3	0
	Females	0	3	0
	Unknown	0	1	0
	Total	**0**	**7**	**0**
Lake Cr.	Males	2	81	0
	Females	1	114	1
	Unknown	1	1	0
	Total	**4**	**196**	**1**
Lemhi R.	Males	0	4	0
	Females	0	16	0
	Unknown	0	0	0
	Total	**0**	**20**	0
Marsh Cr.	Males	1	111	0
	Females	1	84	3
	Unknown	4	1	0
	Total	**6**	**196**	**3**
NF Salmon R.	Males	0	18	0
	Females	0	15	0
	Unknown	0	0	0
	Total	**0**	**33**	**0**
Pahsimeroi R.	Males	0	8	0
	Females	0	8	1
	Unknown	1	0	0
	Total	**1**	**16**	**1**
Secesh R.	Males	1	154	0
	Females	1	163	2
	Unknown	0	2	0
	Total	**2**	**319**	**2**
SF Salmon R.	Males	2	442	2
	Females	2	213	2
	Unknown	12	0	0
	Total	**16**	**655**	**4**
Slate Cr.	Males	0	1	0
	Females	0	4	1
	Unknown	0	0	0
	Total	**0**	**5**	**1**

Table 4. Continued.

Stream	Sex	Unknown	Natural	GP
Upper Salmon R.	Males	1	207	6
	Females	0	84	2
	Unknown	1	3	0
	Total	**2**	**291**	**8**
Valley Cr.	Males	0	22	4
	Females	2	10	2
	Unknown	0	6	0
	Total	**2**	**38**	**6**
WFYF S.R.	Males	0	0	0
	Females	0	0	0
	Unknown	0	0	0
	Total	**0**	**0**	**0**

Juvenile Production Estimates

Rotary Screw Trap Estimates

We operated screw traps to collect brood year 2010 juvenile Chinook salmon on 15 ISS study streams in 2011 and 2012 for 3,807.0 trap days. Brood year 2010 juvenile collection exceeded 300 days (mean = 348.7 d) at 11 traps; three traps operated from 200-299 days (mean = 248.0 d); and one trap operated less than 100 days (33.0 d; Appendix D). High spring runoff, torrential precipitation, and hatchery releases were responsible for most lost trap days, although low summer flows also made some traps inoperable.

Cooperators used data from PIT-tagged and stained fish recaptured at screw traps to estimate the number of brood year 2010 juveniles that migrated from ISS study streams in 2011 and 2012. We collected 304,760 brood year 2010 juvenile Chinook salmon. Summing the point estimates for all the traps yielded a total brood year 2010 migration estimate of 2,434,855 juvenile Chinook salmon from ISS study streams with screw traps. The Salmon River subbasin accounted for the majority of the juvenile production with 281,272 (92.3%) juveniles collected and an estimated 2,238,644 (91.9%) migrants. Migration estimates ranged from 879 fish from Colt Killed Creek to 1,004,413 fish from the Secesh River (Table 5).

Table 5. Seasonal and overall migration estimates of brood year 2010 juvenile Chinook salmon and corresponding lower (LCI) and upper (UCI) 95% confidence intervals from 11 treatment (T) and seven control (C) study streams with rotary screw traps. Estimates are based on the total catch, recapture rate of tagged fish, and the estimated trap efficiency. Instances where no estimate was made are noted NE.

Stream	T/C	Life Stage	Catch	Estimate	LCI	UCI
Clearwater River						
American River	C	Fry	239	7409	2589	10106
		Parr	669	4165	3070	5891
		Presmolt	3,851	13,608	12,050	15,328
		Smolt	1,679	20,335	1,752	26,473
		Brood Year Total	**6,438**	**45,517**	**37,575**	**51,946**

Table 5. Continued.

Stream	T/C	Life Stage	Catch	Estimate	LCI	UCI
Clear Creek	T	Fry	0	NE	NE	NE
		Smolt	0	NE	NE	NE
		Brood Year Total	**0**	**NE**	**NE**	**NE**
Colt Killed Creek	T	Fry	0	NE	NE	NE
		Parr	13	NE	NE	NE
		Presmolt	101	833	475	1,535
		Smolt	21	46	25	82
		Brood Year Total	**135**	**879**	**524**	**1,616**
Crooked Fork Creek	C	Fry	1	NE	NE	NE
		Parr	234	2,714	1,173	5,713
		Presmolt	2,220	9,731	8,900	10,612
		Smolt	261	2,206	1,544	3,194
		Brood Year Total	**2,716**	**14,651**	**12,600**	**17,483**
Crooked River	T	Fry	10	NE	NE	NE
		Parr	82	281	146	536
		Presmolt	167	359	283	458
		Smolt	418	1,304	1,109	1,531
		Brood Year Total	**667**	**1,944**	**1,680**	**2,304**
Red River	T	Fry	180	NE	NE	NE
		Parr	7,240	82,133	68,844	98,755
		Presmolt	4,230	9,859	9,115	10,702
		Smolt	2,046	30,729	24,395	39,628
		Brood Year Total	**13,516**	**132,393**	**116,394**	**115,316**
Salmon River						
Marsh Creek	C	Fry	10,629	72,368	61,631	86,358
		Parr	32,802	154,975	143,929	167,552
		Presmolt	7,693	27,279	25,044	30,020
		Smolt	546	4,113	3,068	5,967
		Brood Year Total	**51,670**	**258,735**	**242,836**	**276,972**
Pahsimeroi River	T	Fry	139	3,531	1,453	7,112
		Parr	388	12,060	7,021	21,448
		Presmolt	2,159	20,978	17,739	26,130
		Smolt	350	7,678	4,700	13,065
		Brood Year Total	**3,036**	**44,247**	**35,688**	**56,020**
Upper Salmon River	T	Fry	215	5,662	1,896	7,347
		Parr	5,670	96,413	80,757	117,266
		Presmolt	4,168	34,307	30,412	39,064
		Smolt	945	8,386	6,835	10,602
		Brood Year Total	**10,998**	**144,768**	**126,842**	**167,060**
South Fork Salmon	T	Fry	355	NA	NA	NA
		Parr	47,578	173,599	164175	184397
		Presmolt	10,123	22,290	21,554	23,340
		Smolt	1,359	4,048	3,623	4,619
		Brood Year Total	**59,060**	**200,603**	**190,892**	**210,811**
Lake Creek	C	Fry	151	1,661	1,114	2,508
		Parr	74,533	454,720	386,666	543,748
		Presmolt	6,106	21,254	18,504	24,439
		Smolt	654	4,762	3,654	6,617
		Brood Year Total	**81,444**	**482,398**	**410,213**	**587,526**
Secesh River	C	Fry	48	1,790	832	3,823
		Parr	52,283	942,374	684,928	1,378,222
		Presmolt	8,265	54,940	48,592	62,180
		Smolt	663	5,308	4,060	7,133
		Brood Year Total	**61,259**	**1,004,413**	**739,384**	**1,432,909**

Table 5. Continued.

Stream	T/C	Life Stage	Catch	Estimate	LCI	UCI
EF Salmon River	T	Parr	494	23,218	4,747	17,132
		Presmolt	6,201	36,093	31,483	37,848
		Smolt	203	1,261	921	1,296
		Brood Year Total	**6,898**	**60,634**	**41,612**	**56,119**
Lemhi River	C	Fry	51	625	221	1,054
		Parr	83	775	414	1,546
		Presmolt	3,191	19,050	17,588	20,794
		Smolt	289	2,505	1,739	3,618
		Brood Year Total	**3,614**	**22,954**	**20,979**	**24,854**
WF Yankee Fork Salmon River	T	Parr	347	1,847	1,590	2,331
		Presmolt	2,848	17,310	15,399	20,868
		Smolt	98	542	363	655
		Brood Year Total	**3,293**	**19,892**	**17,959**	**23,469**

Snorkel Estimates

We used snorkel observations to estimate juvenile Chinook salmon densities in three study streams in the Clearwater subbasin. The observed densities were highly variable and ranged from 0 to 14.38 fish/100 m^2 (Table 6).

Table 6. Densities of brood year 2010 juvenile Chinook salmon calculated from direct underwater observations in Idaho Supplementation Study (ISS) streams without screw traps in 2011.

Stream	Density (Number/100 m^2)
Clearwater River Subbasin	
Fishing Creek	1.55
Legendary Bear Creek	14.38
Pete King Creek	0
Salmon River Subbasin	
Slate Creek	Not sampled

Juvenile Migration and Survival

Comparison of Tag Injector Types

Adequate numbers of fish were tagged at all four traps selected to evaluate the MUI vs. SUI tagging methods and to generate separate survival estimates to LGR for each group. This included all three juvenile life stages from the Knox Bridge (South Fork Salmon River; Figure 2), Marsh Creek (Figure 3), and Big Creek traps (Figure 4). Few parr were collected at the Crooked Fork Creek trap, so a combined parr and presmolt group was used (Figure 5). Ninety-five percent confidence intervals around survival estimates overlapped between methods within each life stage and location (Table 7). Therefore, we conclude that injector type did not have a detectable effect on survival.

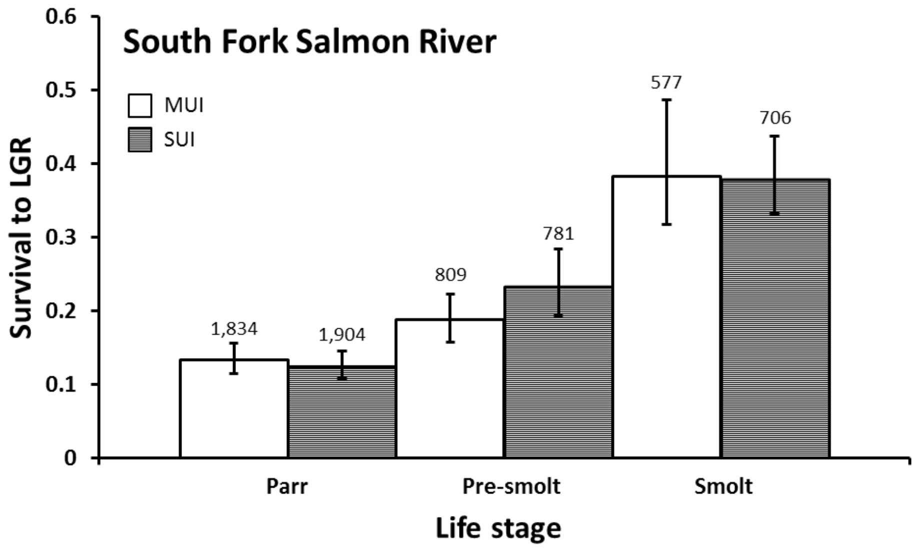

Figure 2. Estimated survival (±95% confidence intervals) of juvenile Chinook salmon from the Knox Bridge trap (South Fork Salmon River) to Lower Granite Dam (LGR) PIT tagged with either multiple use (MUI) or single use (SUI) injectors. Values above the bars indicate the number of fish tagged with each injector type.

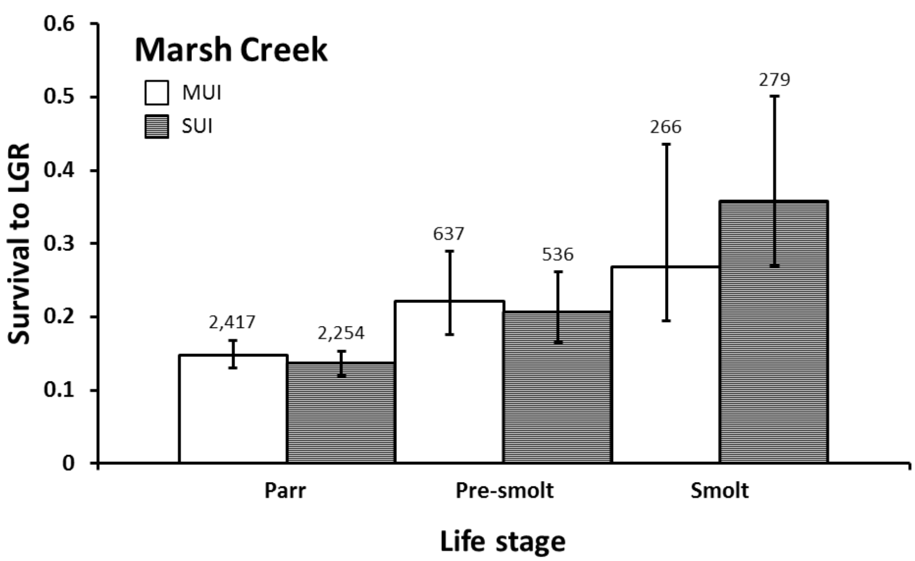

Figure 3. Estimated survival (±95% confidence intervals) of juvenile Chinook salmon from the Marsh Creek trap to Lower Granite Dam (LGR) PIT tagged with either multiple use (MUI) or single use (SUI) injectors. Values above the bars indicate the number of fish tagged with each injector type.

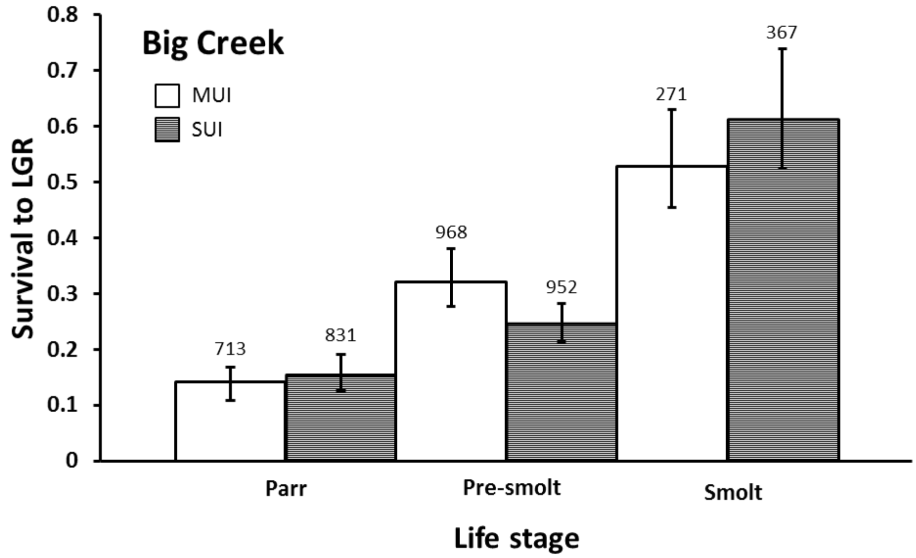

Figure 4. Estimated survival (±95% confidence intervals) of juvenile Chinook salmon from the Big Creek trap to Lower Granite Dam (LGR) PIT tagged with either multiple use (MUI) or single use (SUI) injectors. Values above the bars indicate the number of fish tagged with each injector type.

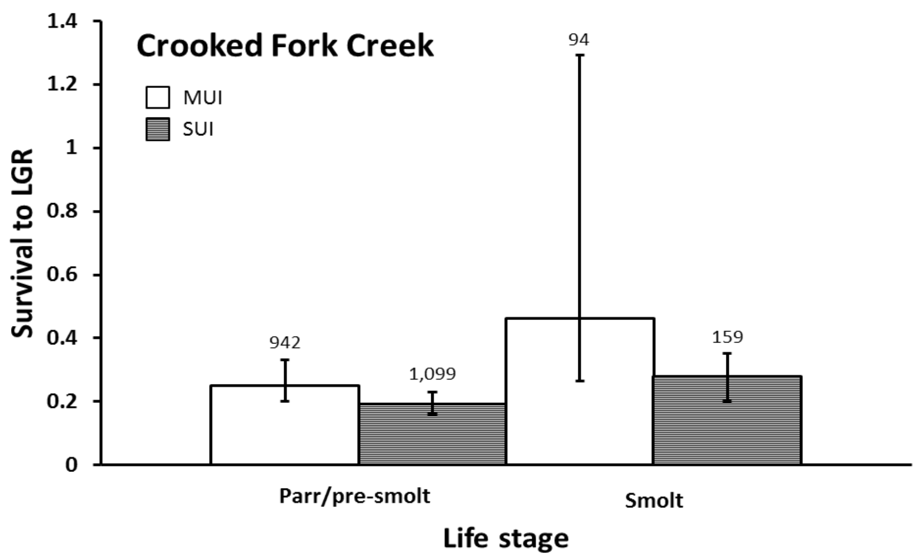

Figure 5. Estimated survival (±95% confidence intervals) of juvenile Chinook salmon from the Crooked Fork Creek trap to Lower Granite Dam (LGR) PIT tagged with either multiple use (MUI) or single use (SUI) injectors. Values above the bars indicate the number of fish tagged with each injector type.

Table 7. Estimated survival (proportion), 95% confidence intervals (CI), and standard error (SE) to Lower Granite Dam for different life stages of naturally produced brood year 2010 juvenile Chinook salmon PIT tagged by either multiple use injectors (MUI) or single use injectors (SUI) at select screw traps. Survival estimates and associated statistics were computed using the SURPH3 Model (Lady et al 2010).

Population	Life stage	Method	Number of fish tagged	Survival estimate	Lower 95% CI	Upper 95% CI	SE
South Fork Salmon River	Parr	MUI	1,834	0.1337	0.1154	0.1555	0.0101
		SUI	1,904	0.1254	0.1081	0.1458	0.1254
	Presmolt	MUI	809	0.1877	0.1579	0.2231	0.0164
		SUI	781	0.2330	0.1936	0.2844	0.0225
	Smolt	MUI	577	0.3834	0.3174	0.4873	0.0405
		SUI	706	0.3792	0.3326	0.4379	0.0261
Big Creek	Parr	MUI	713	0.1412	0.1140	0.1743	0.0151
		SUI	831	0.1546	0.1260	0.1906	0.0259
	Presmolt	MUI	968	0.3215	0.2764	0.3807	0.0417
		SUI	952	0.2453	0.2146	0.2816	0.0161
	Smolt	MUI	271	0.5283	0.4546	0.6291	0.0170
		SUI	367	0.6106	0.5249	0.7387	0.0514
Marsh Creek	Parr	MUI	2,417	0.1477	0.1302	0.1683	0.0096
		SUI	2,254	0.1355	0.1199	0.1531	0.0084
	Presmolt	MUI	637	0.2211	0.1756	0.2890	0.0273
		SUI	536	0.2062	0.1656	0.2619	0.0235
	Smolt	MUI	266	0.2688	0.1948	0.4351	0.0503
		SUI	279	0.3576	0.2702	0.5007	0.0579
Crooked Fork Creek	Parr/pre-smolt	MUI	942	0.2513	0.2010	0.3303	0.0311
		SUI	1,099	0.1912	0.1615	0.2303	0.0170
	Smolt	MUI	94	0.4610	0.2635	1.2929	0.1645
		SUI	159	0.2767	0.2008	0.3528	0.0355

We monitored operational costs at two traps during this test to estimate the cost of both methods on a per fish and per year basis (based on 3,000 fish tagged). Preloaded needles (SUI method) cost $1.89 each (2013 dollars) and were $0.34 more than the tag alone (MUI method), which made the initial cost of the SUI method about $1,000 more (Table 8). However, several factors offset most or all of this cost difference. The SUI method eliminated the need to purchase needles and supplies to sterilize and maintain them, which reduced the cost difference by almost half (Table 8). We also noted personnel savings with the SUI method. When tagging around 100 or more fish per day, technicians saved approximately one hour by not having to stop to reload needles, which further reduced or eliminated the initial cost difference between the two methods.

Screw Trap Estimates

We estimated survival to Lower Granite Dam from PIT tag detections of the various life stage groups of naturally produced juvenile Chinook salmon tagged and released in ISS study streams. A total of 42,045 brood year 2010 parr, presmolts, and smolts were PIT tagged at ISS screw traps for survival estimates. Survival estimates for brood year 2010 parr from study stream to Lower Granite Dam were somewhat higher in the Clearwater than Salmon subbasin. Presmolt and smolt survival were both higher in the Salmon subbasin than in the Clearwater subbasin (Table 9). Parr, presmolt, and smolt survival averaged 13.7%, 25.1%, and 43.3%, respectively, in the Salmon River tributaries. Parr, presmolt, and smolt survival in the Clearwater tributaries averaged 19.2%, 10.1%, and 39.9%, respectively. When a single parr-presmolt survival estimate was calculated in either subbasin this estimate was included with the overall presmolt estimate, since in these instances very few parr were collected. Survival of brood year 2010 age-0 smolts from the Pahsimeroi River to Lower Granite Dam was 38.4% (Table 9).

Table 8. Comparison of operational costs between single use injectors (SUI) and multiple use injectors (MUI). Estimates based on 3,000 fish tagged per calendar year and 2013 prices for bulk (MUI) and preloaded (SUI) PIT tags.

Method	Item	Cost/Unit	Per fish estimate	Cost per tagged fish	Per year estimate (3,000 fish/year)	Cost per trap year
MUI	PIT tags	$1.55 ea.	1 tag/fish	$1.55	3,000 tags	$4,650
	Needles	$2.00 ea.	30 uses/needle	$0.07	100 needles	$200
	Injector materials	$1.00 ea.	--	--	20 new injectors/year	$20
	Alcohol	$27.00/gal	--	--	8 gal/year	$216
	Sponges	$1.00 ea.	--	--	20/year	$20
	Sterilizing containers	$13.00 ea.	--	--	2 new/year	$26
MUI Total				**$1.62**	**--**	**$5,132**
SUI	Preloaded tag	$1.89	1 tag/fish	$1.89	3,000 tags	5,670
	Tagging gun	$35 each	--	--	2 new/year	$70
SUI Total				**$1.89**		**$5,740**

Table 9. Estimated survival (proportion) and standard error (SE) to Lower Granite Dam for different life stages of naturally produced brood year 2010 juvenile Chinook salmon PIT tagged in Idaho Supplementation Studies (ISS) streams. Survival estimates were computed using the SURPH2 or SURPH3 Model (Lady et al. 2001, Lady et al. 2010). Groups having no detections or insufficient detections for estimation are designated ND.

Stream	Life stage	Number tagged	Survival (SE)
Salmon Subbasin			
Lemhi River	Fry	45	ND
Lemhi River	Parr	82	0.0495 (0.103)
Lemhi River	Presmolt	3187	0.512 (0.025)
Lemhi River	Age-1 smolt	286	0.871 (0.126)
South Fork Salmon River	Parr	3,735	0.130 (0.01)
South Fork Salmon River	Presmolt	1,590	0.210 (0.01)
South Fork Salmon River	Smolt	1,306	0.372 (0.02)
Marsh Creek	Parr	5,339	0.1396 (0.01)
Marsh Creek	Presmolt	1,915	0.2020 (0.01)
Marsh Creek	Smolt	572	0.3059 (0.04)
Pahsimeroi River	Age-0 smolt	441	0.3841 (0.05)
Pahsimeroi River	Parr	65	0.2615 (0.08)
Pahsimeroi River	Presmolt	2,167	0.3752 (0.01)
Pahsimeroi River	Age-1 smolt	349	0.6129 (0.04)

Table 9. Continued.

Stream	Life stage	Number tagged	Survival (SE)
Upper Salmon River	Parr	3,740	0.1713 (0.01)
Upper Salmon River	Presmolt	1,865	0.2345 (0.01)
Upper Salmon River	Smolt	945	0.4918 (0.03)
East Fork Salmon River	Parr	57	ND
East Fork Salmon River	Presmolt	349	0.21 (0.09)
East Fork Salmon River	Smolt	188	0.51 (0.05)
West Fork Yankee Fork	Parr	14	ND
West Fork Yankee Fork	Presmolt	276	0.28 (0.07)
West Fork Yankee Fork	Smolt	89	0.52 (0.11)
Lake Creek	Parr	172	0.101 (0.0343)
Lake Creek	Parr 8.5/9mm	714	0.067 (0.0126)
Lake Creek	Presmolt	889	0.130 (0.0209)
Lake Creek	Smolt	652	0.114 (0.0194)
Lake Creek	Yearlings	610	0.117 (0.0154)
Secesh River	Parr	570	0.103 (0.0167)
Secesh River	Parr 8.5/9mm	860	0.089 (0.0122)
Secesh River	Presmolt	1816	0.102 (0.0101)
Secesh River	Smolt	602	0.100 (0.0224)
Secesh River	Yearlings	406	0.142 (0.0201)
Clearwater Subbasin			
American River	Parr	75	0.133 (0.040)
American River	Presmolt	723	0.091 (0.013)
American River	Smolt	1,392	0.397 (0.051)
Clear Creek	Presmolt	0	ND
Clear Creek	Smolt	0	ND
Colt Killed Creek	Parr-Presmolt	105	0.1333 (0.03)
Colt Killed Creek	Smolt	21	0.3810 (0.11)
Crooked Fork Creek	Parr	63	0.3439 (0.12)
Crooked Fork Creek	Presmolt	1,980	0.0292 (0.02)
Crooked Fork Creek	Smolt	263	0.3194 (0.05)
Crooked River	Presmolt	85	0.164 (0.040)
Crooked River	Smolt	389	0.541 (0.072)
Fishing Creek	Parr	112	0.208 (0.0776)
Legendary Bear	Parr	723	0.206 (0.0248)
Red River	Parr	667	0.070 (0.012)
Red River	Presmolt	968	0.089 (0.013)
Red River	Smolt	1,838	0.357 (0.059)

Summary Parr Remote PIT Tagging

Efforts to tag summer parr in ISS streams were variable in 2011. We tagged 1,182 summer parr in three streams in 2011 (Table 10). The number of parr tagged ranged from 112 in Fishing Creek to 723 in Legendary Bear Creek (Table 10).

Table 10. Number of brood year 2010 Chinook salmon summer parr PIT tagged in Idaho Supplementation Study (ISS) streams during 2011. Legendary Bear and Fishing creeks are proposed name changes for Papoose and Squaw creeks, respectively.

Stream	Number PIT tagged
Clearwater River Subbasin	
Legendary Bear Creek	723
Fishing Creek	112
Salmon River Subbasin	
Lemhi River	347[a]

[a] IDFG was unsuccessful in the tagging in 2011 due to higher than normal river levels. ISEMP (Project Number) personnel collected 347 parr in the Lemhi using a seine (n = 14), angling (n = 29), and electrofishing (n = 304).

DISCUSSION

SUI vs. MUI Comparison

We found no significant differences, or consistent trends, in survival estimates to LGR between groups of fish tagged with SUI vs. MUI for any life stage or location. Based on this, it is our conclusion that ISS cooperators that wish to switch to SUI can do so without affecting either future results or comparability with past findings.

Although neither method appears to provide a survival advantage, the use of SUI does have some appeal. Taggers involved in the comparison unanimously favored this method because needles are always sharp and tagging sessions are shortened when large numbers of fish are present. This reduced personnel time may lead to actual cost savings at traps that tag large numbers of fish each year. Cooperators with traps that do not typically tag large numbers of fish will need to evaluate whether the convenience of preloaded needles is worth the additional upfront cost.

Clear Creek Trap Relocation

The Clear Creek screw trap had been located immediately below the Kooskia Hatchery intake. Renovations to the intake rendered the site unusable. In response, the trap was relocated approximately 1 km downstream in 2011. The new site was marginal due to lack of a pool deep enough to float the screw trap and allow for the rotation of the cone, even at high flows. This site was abandoned in 2012 and a new trapping technique (fyke net) was employed. The use of a fyke net has been complicated by several factors, primarily the inability to maintain the net during periods of high flow when large amounts of debris are flushing out of the system and the lack of stream coverage provided by the net. Fyke net installation was delayed until flows diminished and debris loads were lighter; after the peak passage of smolts. As a result, less than ten spring Chinook smolts were collected.

Redd Count Methodology

The spawning distribution of Chinook salmon has shifted dramatically upstream after the Big Springs Creek reconnect in the Pahsimeroi River. Areas that were previously unavailable for spawning are now being utilized, with a concurrent reduction in spawning in the traditional spawning areas. Much of the newly accessible spawning area is on private property, on which access has not been granted. In response, we will need to use a combination of ground and aerial redd counts to complete our counts in this system. We will consider these changes in our final analyses; however the aerial redd counts on the sections we are unable to access from the ground will be the only counts available.

Big Timber Creek was reconnected to the Lemhi River in 2009, which added an additional 15 km of potential spawning and rearing habitat. No spawning has been documented to date, but we will continue aerial redd counts.

After the helicopter accident IDFG re-evaluated where aerial redd counts could be reduced. In response, several aerial counts were replaced with ground counts. In the Clearwater subbasin, a single pass ground count will replace the traditional single flight on White Cap Creek. In the Salmon subbasin one aerial transect on the upper Salmon River (OS-6) will be replaced with a single ground count, and we will conduct a single ground count on Alturas Lake Creek covering transects OS1-3 and NS-12. Ground counts in both subbasins will be timed to correspond with peak spawning activity and aerial counts in adjacent stream reaches.

Effects of Other Programs

Beginning with brood year 2010 and continuing through the end of the ISS program, consistent with the HSRG guidance, a portion of the Chinook salmon broodstocks at the Sawtooth, Pahsimeroi, and McCall hatcheries were used to create an integrated program. The purpose of this program was to incorporate a number of natural origin adults into the hatchery program. To avoid removing ISS treatment adults from natural spawning and evaluation areas, it was decided that for brood years 2010-2012 only sexually mature males collected at hatchery traps on spawning days would be used in the integrated program. An approximate 5 ml sample of milt was expressed from sexually mature males and used to fertilize eggs from hatchery origin females. The males were then passed immediately over the weir. It was our judgment that this action would not affect the spawning performance of these fish or the overall productivity of the population (Young 2009).

The Idaho Department of Fish and Game is continuing a summer-run Chinook salmon program within the South Fork Clearwater River drainage, which began in 2009. Biologists transferred 218,901 fertilized eggs from the summer-run stock at McCall Hatchery to the Clearwater Hatchery in 2010, which produced 206,600 smolts for release in 2012. The Clearwater Hatchery is raising the fish for release at the Crooked River satellite facility. Juveniles in this release group will be ad-intact to prevent harvest in the sport fishery and increase adult rack returns, but will be 100% coded-wire tagged to distinguish them from natural origin fish returning to the weir. Adults from the initial release (BY2009) returned as jacks in 2012, and hatchery or program personnel removed them at the Crooked River weir to preserve the ISS adult protocol.

In 2010, additional Chinook salmon releases not associated with the ISS program occurred in ISS study streams. We report these activities to ensure that their effects are included in future analyses. The IDFG Chinook Captive Rearing Program (BPA project number

1997-001-00) made adult releases into the West Fork Yankee Fork Salmon River and East Fork Salmon River. The West Fork Yankee Fork received 14 adults, which constructed one redd in the West Fork Yankee Fork. The East Fork Salmon River received five adults from this program, which produced one redd (Stark and Richardson 2011).

The Shoshone Bannock Tribes Supplementation Monitoring and Evaluation Program is continuing an on-going Chinook salmon reintroduction project in the Yankee Fork Salmon River initiated in 2008 to assist in returning 2,000 adults for Tribal conservation and harvest management objectives. Operations include managing two adult picket weirs for adult escapement and a screw trap on the mainstem Yankee Fork for juvenile emigration. All natural adults collected at the lower weir are released immediately above the weir for natural spawning. Any hatchery influence (i.e., returns or adult outplants) is transported above the upper weir for spawning to prevent migration into the West Fork Yankee Fork to minimize conflicts and preserve protocols with the ongoing Idaho Supplementation Studies.

Adult Escapement

Total spawning escapement provided by the Peterson mark-recapture estimates (Appendix C) is an important analysis variable for the ISS program and should be continued on all streams with weirs. The exception would be streams with video or acoustic weirs, where marking would not be possible. Based on this analysis, all fish released above study weirs should be opercle punched and the presence/absence of this mark should be recorded during all carcass collections.

Summer Parr Remote PIT Tagging

Since NOAAF collects and PIT tags summer parr in a number of ISS study streams (Lake Creek, Secesh River, Bear Valley Creek, Valley Creek, Marsh Creek, South Fork Salmon River, Herd Creek), we do not collect summer parr for our program in these streams. Data from NOAAF marked fish will be available for future analyses and can be found in reports from Project Number 1991-028-00.

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APPENDICES

Appendix A. Table 1. The number, origin, and sex (male = M, female = F, and undetermined = U) of adult Chinook salmon captured or counted at weirs on Idaho Supplementation Study (ISS) streams in 2011. Catch numbers are not expanded and do not represent total escapement, but see Appendix C. General production adults were generally not passed over the weirs.

	General production			Natural			Undetermined			
Stream Name	**M**	**F**	**U**	**M**	**F**	**U**	**M**	**F**	**U**	**Total**
Clearwater River Subbasin										
Clear Creek	756	488	0	9	2	0	0	0	0	1,255
Crooked Fork Creek	40	40	2	15	12	0	0	0	0	109
Crooked River	0	0	329	17	7	3	0	0	0	356
Red River	0	0	500	17	10	3	0	0	0	530
Salmon River Subbasin										
Lake Creek										255
Pahsimeroi River	1,401	2,024	0	216	160	0	0	0	0	3,801
South Fork Salmon River	2,422	1,518	0	395	309	0	6	4	0	4,654
East Fork Salmon River	3	1	0	146	62	4	0	0	0	216
Upper Salmon River	3,560	232	0	408	191	0	0	0	0	4,391

Appendix A. Table 2. Number of Chinook salmon redds counted in survey transects within Idaho Supplementation Study (ISS) streams in 2011 and summary information on transect length, number of passes, method of data collection, and when redd counting effort was stopped. Cases for which no data were available are designated ND.

Stream	Survey length (km)	Redds	Redds per km	Passes	Last pass	Survey method
Clearwater Subbasin						
American R.	34.6	160	4.62	3	09/20/11	Ground
Big Flat Cr.	5.2	0	0	1	09/04/11	Ground
Brushy Fk. Cr.	16.1	38	2.36	3	09/14/11	Ground
Clear Cr.	20.2	55	2.72	4	09/20/11	Ground
Colt Killed Cr.	50.9	25	0.41	1	09/08/11	Ground
Crooked Fk. Cr.	21.7	137	6.31	3	09/15/11	Ground
Crooked R.	18.8	15	0.80	3	09/19/11	Ground
Fishing Cr.	6.0	5	0.83	3	09/07/11	Ground
Legendary Bear Cr.	6.8	36	5.29	3	09/08/11	Ground
Pete King Cr.	5.8	1	0.17	3	09/22/11	Ground
Red R.	38.5	204	5.30	3	09/21/11	Ground
White Cap Cr.	14.0	4	0.29	1	09/13/11	Ground
Salmon Subbasin						
Alturas Lake Cr.	16.6	7	0.42	1	09/07/11	Ground
Bear Valley Cr.	35.7	252	1.06	5	09/13	Ground
EF Salmon R.	27.0	21	0.78	3	09/07	Ground
Herd Cr.	16.4	60	3.66	3	09/07	Ground
Lake Cr.	16.8	134	7.98	3	09/01/11	Ground
Lemhi R.	51.7	123	2.38	4/1	09/21/11	Ground/Aerial
Marsh Cr.	20.2	160	7.92	6	09/05/11	Ground
NF Salmon R.	36.8	58	1.58	4	09/08/11	Ground
Pahsimeroi R.	31.5	115	3.65	3	09/30/11	Ground/Aerial
Secesh R.	40.1	257	6.41	3	09/16/11	Ground
SF Salmon R.	25.3	274	10.83	4	09/07/11	Ground
W.F. Yankee Fork S.R.	11.6	3	0.26	3	09/15	Ground
Upper Salmon R.	42.5	111	2.60	1	09/07/11	Ground/Aerial
Valley Cr.	33.2	86	2.59	3	09/14	Ground
Slate Cr.	15.4	14	0.90	3	09/14/11	Ground

Appendix A. Table 3. Number, origin (GP = general production hatchery), and sex of adult Chinook salmon carcasses collected during 2011 spawning ground surveys on Idaho supplementation study (ISS) streams.

Stream	Sex	Unknown	Natural	GP	Total
Clearwater R.					
American R.	Males	1	10	40	51
	Females	0	12	45	57
	Unknown	8	0	3	11
	Total	**9**	**22**	**88**	**119**
Big Flat Cr.	Males	0	0	0	0
	Females	0	0	0	0
	Unknown	0	0	0	0
	Total	**0**	**0**	**0**	**0**
Brushy Fk. Cr.	Males	0	0	0	0
	Females	0	2	3	5
	Unknown	0	0	0	0
	Total	**0**	**2**	**3**	**5**
Clear Cr.	Males	0	2	41	43
	Females	0	1	11	12
	Unknown	0	0	0	0
	Total	**0**	**3**	**52**	**55**
Colt Killed Cr.	Males	0	2	1	3
	Females	0	2	1	3
	Unknown	0	1	0	1
	Total	**0**	**5**	**2**	**7**
Crooked Fk. Cr.	Males	0	11	23	34
	Females	0	8	27	35
	Unknown	0	1	1	2
	Total	**0**	**20**	**51**	**71**
Crooked R.	Males	0	4	1	5
	Females	0	4	1	5
	Unknown	2	0	1	3
	Total	**2**	**8**	**3**	**13**
Fishing Cr.	Males	0	0	0	0
	Females	0	1	2	3
	Unknown	0	0	0	0
	Total	**0**	**1**	**2**	**3**
Legendary Bear Cr.	Males	0	0	3	3
	Females	0	1	2	3
	Unknown	4	0	0	4
	Total	**0**	**1**	**5**	**10**
Pete King Cr.	Males	0	0	0	0
	Females	0	1	0	1
	Unknown	0	0	0	0
	Total	**0**	**1**	**0**	**1**
Red R.	Males	2	12	104	118
	Females	1	15	108	125
	Unknown	17	2	31	50
	Total	**20**	**29**	**243**	**293**
Salmon R.					
Bear Valley Cr.	Males	0	92	0	92
	Females	0	90	0	90
	Unknown	0	33	0	33
	Total	**0**	**215**	**0**	**215**
E. Fork Salmon R.	Males	0	10	0	10
	Females	0	6	0	6
	Unknown	0	0	0	0
	Total	**0**	**16**	**0**	**16**

Table 3. Continued.

Stream	Sex	Unknown	Natural	GP	Total
Herd Cr.	Males	0	4	0	4
	Females	0	24	0	24
	Unknown	0	6	0	6
	Total	**0**	**34**	**0**	**34**
Lake Cr.	Males	1	33	0	34
	Females	0	44	0	44
	Unknown	0	0	0	0
	Total	**1**	**77**	**0**	**78**
Lemhi R.	Males	0	2	1	3
	Females	0	19	1	20
	Unknown	0	0	0	0
	Total	**0**	**21**	**2**	**25**
Marsh Cr.	Males	0	74	0	74
	Females	0	74	1	75
	Unknown	0	0	0	0
	Total	**0**	**148**	**1**	**149**
N. Fork Salmon R.	Males	0	5	0	5
	Females	0	19	0	19
	Unknown	0	0	0	0
	Total	**0**	**24**	**0**	**24**
Pahsimeroi R.	Males	0	22	0	22
	Females	0	10	0	10
	Unknown	0	0	1	1
	Total	**0**	**32**	**1**	**33**
Secesh R.	Males	0	128	10	138
	Females	4	110	6	120
	Unknown	5	0	0	5
	Total	**9**	**238**	**16**	**263**
S. Fork Salmon R.	Males	0	177	0[a]	177
	Females	0	100	0	100
	Unknown	3	0	0	3
	Total	**3**	**277**	**0**	**280**
Slate Cr.	Males	0	0	1	1
	Females	0	0	0	0
	Unknown	0	0	0	0
	Total	**0**	**0**	**1**	**1**
Upper Salmon R.	Males	0	122	2	124
	Females	0	36	1	37
	Unknown	0	0	0	0
	Total	**0**	**158**	**3**	**161**
Valley Cr.	Males	0	3	0	3
	Females	0	14	0	14
	Unknown	0	2	0	2
	Total	**0**	**19**	**0**	**19**
W. Fork Yankee	Males	0	0	0	0
Fork Salmon R.	Females	0	1	0	1
	Unknown	0	0	0	0
	Total	**0**	**1**	**0**	**1**

[a] Three GP jacks were found in Cabin Creek adjacent to the South Fork Salmon River Road. All had a left opercal punch, consistent with fish recycled through the fishery downstream from weir; thus, we suspect they arrived anthropogenically, and did not escape through the weir.

Appendix A. Table 4. Summary of adult Chinook salmon passed above weirs as adult treatments to Idaho Supplementation Study (ISS) streams in 2011. Treatments are broken down by sex (male = M, female = F, and undetermined = U) and origin. Release numbers are not expanded and do not represent total escapement.

	Natural			General production			Total
	M	**F**	**U**	**M**	**F**	**U**	
Clearwater Subbasin							
Clear Creek	9	2	0	0	0	0	11
Crooked Fork Creek	15	12	0	0	0	0	27
Crooked River	17	7	3	0	0	0	27
Red River	17	10	3	0	0	0	30
Salmon Subbasin							
Lake Creek							255
Pahsimeroi River	214	158	0	0	0	0	372
S. Fork Salmon River	385[a]	308	0	0	0	0	693
E. Fork Salmon River	145	62	4	0	0	0	211
Upper Salmon River	406	191	0	0	0	0	597

a Includes 75 males used in the integrated broodstock program before being released.

Appendix B. Table 1. The number, origin, and sex (male = M, female = F, and undetermined = U) of adult Chinook salmon captured or counted at weirs on Idaho Supplementation Study (ISS) streams in 2012. Catch numbers are not expanded and do not represent total escapement. General production adults were generally not passed over the weirs, but see Appendix C.

	General production			Wild/Natural			Undetermined			
Stream Name	**M**	**F**	**U**	**M**	**F**	**U**	**M**	**F**	**U**	**Total**
Clearwater R. Subbasin										
Clear Creek	397	488	125	8	1	1	0	0	0	1,020
Crooked Fork Creek	7	5	0	7	0	0	0	0	0	19
Crooked River	2	2	68	19	20	1	0	0	0	112
Red River	4	2	837	45	38	4	0	0	0	930
Salmon R. Subbasin										
Lake Creek										265
Pahsimeroi River	344	301	0	127	89	0	0	0	0	861
South Fork Salmon River	1,116	1,141	0	251	205	0	0	0	0	2,713
East Fork Salmon River	0	0	0	133	111	0	0	0	0	244
Upper Salmon River	3,359	2,886	0	308	196	0	0	0	0	6,749

Appendix B. Table 2. Summary of adult Chinook salmon passed above weirs as adult treatments to Idaho Supplementation Study (ISS) streams in 2012. Treatments are broken down by sex (male = M, female = F, and undetermined = U) and origin. Release numbers are not expanded and do not represent total escapement.

	Natural			General production			
	M	**F**	**U**	**M**	**F**	**U**	**Total**
Clearwater Subbasin							
Clear Creek	1	8	1	0	0	0	10
Crooked Fork Creek	7	0	0	0	0	0	7
Crooked River	19	20	1	2	2	0	44
Red River	45	38	4	4	2	1	94
Salmon Subbasin							
Lake Creek							265
Pahsimeroi River	127[a]	89	0	0	0	0	216
South Fork Salmon River	250[b]	204	0	0	0	0	454
East Fork Salmon River	133	111	0	0	0	0	
Upper Salmon River	308[c]	196	0	0	0	0	504

[a] Includes 19 males spawned in the integrated broodstock program and released.
[b] Includes 49 males spawned in the integrated broodstock program and released.
[c] Includes 27 males spawned in the integrated broodstock program and released.

Appendix B. Table 3. Number of Chinook salmon redds counted in survey transects within Idaho Supplementation Study (ISS) streams in 2012 and summary information on transect length, number of passes, method of data collection, and date of final redd count. Cases where no data are available are designated ND.

Stream	Survey length (km)	Redds	Redds per km	Passes	Last pass	Survey method
Clearwater Subbasin						
American R.	34.6	102	2.95	3	9/19	Ground
Big Flat Cr.[d]	5.2	ND	ND	ND	ND	ND
Brushy Fk. Cr.	21.7	35	1.61	3	9/05	Ground
Clear Cr.	20.2	45	2.22	4	9/10	Ground
Colt Killed Cr.[d]	50.9	ND	ND	ND	ND	ND
Crooked Fk. Cr.	21.7	97	4.47	4	9/12	Ground
Crooked R.	18.8	2	0.11	1	8/23	Ground
Fishing Cr.	6.0	19	3.17	3	9/10	Ground
Legendary Bear Cr.	6.8	17	2.5	3	9/11	Ground
Pete King Cr.	5.8	1	0.17	3	9/11	Ground
Red R.	38.5	129	3.35	3	9/18	Ground
White Cap Cr.	12.9	2	0.16	1	9/11	Ground
Salmon Subbasin						
Alturas Lake Cr.	16.6	11	0.66	1	9/07	Ground
Bear Valley Cr.	35.7	272	7.62	3	9/11	Ground
EF Salmon R	27.0	95	3.52	3	9/10	Ground
Herd Cr.	17.1	63	3.68	3	9/11	Ground
Lake Cr.	16.8	136	8.10	3	9/05	Ground
Lemhi R.	51.7	82	1.59	4/1	9/17	Ground/Aerial
Marsh Cr.	14.7	118	8.02	4	9/04	Ground
Knapp Cr.[c]	5.5	13	2.36	1	9/5	Aerial
NF Salmon R.[a]	36.8	42	1.14	2	9/04	Ground
Pahsimeroi R.	26	134	3.32	3	10/02	Ground
Secesh R.	40.1	242	6.03	3	9/17	Ground
SF Salmon R.	25.3	196	7.74	4	9/11	Ground
Slate Cr.	7.5	12	1.6	2	8/31	Ground
Upper Salmon R.	51.7	181	3.50	1	9/05	Aerial
Valley Cr.[b]	33.2	129	3.89	3	9/19	Ground
WF Yankee Fork S.R.[e]	11.6	9	0.78	1	9/19	Ground

[a] Partial third pass, but only in core areas due to the Mustang Complex Fire.
[b] Only two passes (1st and last) completed in upper Valley Creek due to Halstead Complex Fire.
[c] Only one pass due to Halstead Fire. Typically, Knapp Cr. count combined with Marsh Cr.
[d] Could not access streams due to Powell Complex Fire.
[e] Only one pass was possible due to Halstead Complex Fire

Appendix B. Table 4. Number, origin, and sex of adult Chinook salmon carcasses collected during 2012 spawning ground surveys on Idaho Supplementation Study (ISS) streams. Streams where no data were collected are designated ND.

Stream	Sex	Unknown	Natural	General production
Clearwater Subbasin				
American R.	Male	2	42	7
	Female	3	39	14
	Unknown	6	5	4
	Total	**11**	**86**	**25**
Big Flat Cr.[a]	Males	ND	ND	ND
	Females	ND	ND	ND
	Unknown	ND	ND	ND
	Total	**ND**	**ND**	**ND**
Brushy Fk. Cr.	Males	0	3	3
	Females	1	7	2
	Unknown	0	0	0
	Total	**1**	**10**	**5**
Clear Cr.	Males	0	1	24
	Females	0	1	32
	Unknown	0	0	0
	Total	**0**	**2**	**56**
Colt Killed Cr.[a]	Males	ND	ND	ND
	Females	ND	ND	ND
	Unknown	ND	ND	ND
	Total	**ND**	**ND**	**ND**
Crooked Fk. Cr.	Males	0	17	7
	Females	2	12	16
	Unknown	0	0	0
	Total	**2**	**29**	**23**
Crooked R.	Males	0	0	0
	Females	0	1	0
	Unknown	1	2	0
	Total	**1**	**2**	**0**
Fishing Cr.	Males	0	2	1
	Females	2	10	0
	Unknown	0	0	0
	Total	**2**	**12**	**1**
Legendary Bear Cr.	Males	0	1	0
	Females	0	4	2
	Unknown	3	0	0
	Total	**3**	**5**	**2**
Pete King Cr.	Males	0	0	0
	Females	1	0	0
	Unknown	0	0	0
	Total	**1**	**0**	**0**
Red R.	Males	14	77	132
	Females	15	49	218
	Unknown	56	16	39
	Total	**85**	**142**	**389**

Appendix B. Table 4. (continued)

Stream	Sex	Unknown	Natural	General production
Salmon Subbasin				
Bear Valley Cr.	Males	0	27	0
	Females	0	29	0
	Unknown	0	0	0
	Total	**0**	**56**	**0**
EF Salmon R.	Males	0	64	0
	Females	0	36	0
	Unknown	0	0	0
	Total	**0**	**100**	**0**
Herd Cr.	Males	0	3	0
	Females	0	4	0
	Unknown	0	0	0
	Total	**0**	**7**	**0**
Lake Cr.	Males	0	36	1
	Females	1	76	1
	Unknown	1	2	0
	Total	**2**	**114**	**2**
Lemhi R.	Males	0	2	0
	Females	0	11	0
	Unknown	0	0	0
	Total	**0**	**13**	**0**
Marsh Cr.	Males	1	38	1
	Females	0	55	1
	Unknown	0	0	0
	Total	**1**	**93**	**2**
NF Salmon R.	Males	0	5	0
	Females	0	10	0
	Unknown	0	0	0
	Total	**0**	**15**	**0**
Pahsimeroi R.	Males	0	8	0
	Females	0	1	0
	Unknown	0	0	0
	Total	**0**	**9**	**0**
Secesh R.	Males	1	104	1
	Females	2	122	1
	Unknown	1	1	0
	Total	**4**	**227**	**2**
S.F. Salmon R.	Males	1	84	12
	Females	2	70	6
	Unknown	6	0	0
	Total	**9**	**154**	**18**
Slate Cr.	Males	0	0	0
	Females	0	1	0
	Unknown	0	0	0
	Total	**0**	**1**	**0**
Upper Salmon R.	Males	1	138	52
	Females	0	69	19
	Unknown	0	0	0
	Total	**1**	**207**	**71**
Valley Cr.	Males	0	7	0
	Females	0	7	0
	Unknown	0	0	0
	Total	**0**	**14**	**0**

Appendix B. Table 4. (continued)

Stream	**Sex**	**Unknown**	**Natural**	**General production**
WFYF S.R.	Males	0	0	0
	Females	0	0	0
	Unknown	0	0	0
	Total	**0**	**0**	**0**

[a] Stream could not be accessed due to Powell Complex Fire.

Appendix C. Expanded (Peterson estimator; Everhart and Youngs 1981) estimates of spawning escapement into project study streams with weirs for years in which mark-recapture data were collected. Streams for which no data are available are designated ND.

Stream	Year	Marked fish: Number passed	Marked fish: Number recovered	Unmarked fish: Number passed	Unmarked fish: Number recovered	Escapement estimate upstream from weir: Estimate	Escapement estimate upstream from weir: ± 95% Confidence interval
Clearwater Subbasin							
Clear Creek	2010	7	0	0	233	ND	ND
	2009	10	1	0	13	150	270
	2008	15	12	0	113	156	38
	2007	19	3	0	7	63	55
	2006	30	5	0	14	114	79
	2005	17	3	0	10	74	67
	2004	122	15	0	60	610	259
	2003	65	1	0	13	910	1,706
	2002	56	4	0	89	1,302	1,203
Crooked Fork Creek	2010	24	0	0	33	NE	NE
	2009	20	5	0	29	136	96
	2008	43	16	0	90	285	102
	2007	33	2	0	33	578	754
	2006	23	3	0	16	146	142
	2005	28	0	0	9		
	2004	81	15	0	36	275	106
	2003	40	1	0	10	440	813
	2002	35	4	0	86	788	710
	2001	176	26	1	200	1,530	511
	2000	17	2	2	95	825	1,063
	1999	0	0	3	19		
Lolo Creek[a]	2010	23	0	0	8	101[b]	ND
	2009	33	7	0	0	141	ND
	2008	58	17	0	36	182	54
Total		0	0	0	16	29[b]	ND
Upper	2007	0	0	0	0		
Lower		0	0	0	16		
Total		16	3	0	0	34[c]	ND
Upper	2006	12	1	0	0		
Lower		4	2	0	0		
Total		27	4	0	22	176	146
Upper	2005	13	1	0	9	130	233
Lower		14	3	0	13	75	68
Total		154	33	0	72	490	123
Upper	2004	143	31	0	22	244	49
Lower		11	2	0	50	286	352
Total		23	2	0	69	817	1,067
Upper	2003	10	1	0	16	170	702
Lower		13	1	0	53	308	1,311
Total	2002	111	22	0	121	621	211
Total	2001	1,081	363	0	523	2,638	170
Total	2000	161	19	0	102	1,025	398
Total	1999	65	4	0	3	114	71
Newsome Creek[a]	2010	137	15	0	5	183	44
	2009	26	1	0	4	150	37
	2008	47	6	0	2	62	19
	2007	3	0	8	2	11	ND
	2006	3	1	0	0	3	0
	2005	24	6	0	2	32	11
	2004	83	17	0	1	88	9

Appendix C. Continued.

Stream	Year	Marked fish		Unmarked fish		Escapement estimate upstream from weir	
		Number passed	Number recovered	Number passed	Number recovered	Estimate	± 95% Confidence interval
	2003	290	49	0	20	408	56
	2002	219	43	0	5	244	21
	2001	263	88	0	24	335	26
	2000	93	15	0	21	223	79
Salmon Subbasin							
Johnson Creek	2009	666	318	0	46[d]	786	33
	2008	550	328	0	4	557	4
	2007	315	103	0	7	336	14
	2006	113	57	0	0	113	0
	2005	119	65	0	0	119	0
	2004	246	68	0	6	267	16
	2003	691	478	0	16	714	6
	2002	1,085	606	0	11	1,105	8
	2001	1,335	837	0	4	1,341	4
	2000	78	19	0	8	110	22
	1998	60	38	0	30	107	14
Pahsimeroi River	2010	293	15	0	2	332	56
	2009	322	22	0	2	368	54
	2008	229	29	0	0	229	0
South Fork Salmon River	2010	1,339	651	2	9	1,358	9
	2009	546	291	0	2	550	4
	2008	589	261	0	4	598	7
	2007	337	101	0	10	370	18
	2006	505	119	0	26	615	45
	2005	382	165	0	10	405	11
	2004	849	216	0	451	2,622	248
	2003	2,381	1,235	0	177	2,722	44
	1997	547	322	0	80	700	23
Upper Salmon River	2010	723	293	0	7	740	10
	2009	447	100	0	1	452	8
	2008	390	107	0	55	590	56
	2007	206	76	0	0	206	0
	2006	394	135	0	4	406	9
	2005	445	96	0	0	445	0
	2004	709	185	0	5	728	15
	1999	128	28	0	3	142	14

[a] Adults removed for Nez Perce Tribal Hatchery broodstock not included in these estimates.
[b] Based on an expansion of 2.1 fish per redd for redds located above the lower weir.
[c] Based on an expansion of 2.3 fish per redd for redds located above the lower weir.
[d] All unmarked fish recovered were age 3 males; likely a small hole in a picket weir. All adults (>age 3) recovered were marked (n = 209).

Appendix D. Juvenile trap operations to collect brood year 2010 spring/summer Chinook salmon in Idaho Supplementation Study (ISS) streams. The spring trapping season extends from trap deployment in the spring to June 30. The summer season extends from July 1 to August 31. The fall season runs from September 1 to trap removal.

Stream	Season and Calendar Year	Start Date	End Date	Total Days Trapped
Clearwater River Subbasin				
American River	Spring 2011	03/23/2011	06/30/2011	88.5
	Summer 2011	07/01/2011	08/30/2011	54.0
	Fall 2011	09/01/2011	10/24/2011	49.0
	Spring 2012	03/22/2012	06/30/2012	98.0
	Total	**03/23/2011**	**06/30/2012**	**289.5**
Clear Creek	Fall 2011	09/29/2011	11/03/2011	12
	Spring 2012	060/8/2012	06/29/2012	21
	Total	**09/29/2011**	**06/29/2012**	**33.0**
Crooked River	Spring 2011	03/23/2011	06/30/2011	94.5
	Summer 2011	07/01/2011	08/31/2011	56.0
	Fall 2011	09/01/2011	10/24/2011	50.0
	Spring 2012	03/29/2012	06/30/2012	94.0
	Total	**03/23/2011**	**06/30/2012**	**294.5**
Red River	Spring 2011	04/10/2011	06/30/2011	78.5
	Summer 2011	07/01/2011	08/31/2011	56.0
	Fall 2011	09/01/2011	10/24/2011	52.5
	Spring 2012	04/09/2012	07/10/2012	91.0
	Total	**04/10/2011**	**07/10/2012**	**278.0**
Crooked Fork Creek	Spring 2010	03/23/2011	06/30/2011	48
	Summer 2010	07/01/2011	08/31/2011	57.5
	Fall 2010	09/01/2011	11/07/2011	62.5
	Spring 2011	03/21/2012	06/30/2012	69
	Total	**03/23/2011**	**06/30/2012**	**237.0**
Colt Killed Creek	Spring 2010	03/23/2011	06/30/2011	49
	Summer 2010	07/01/2011	08/31/2011	57
	Fall 2010	09/01/2011	11/07/2011	65
	Spring 2011	03/21/2012	06/30/2012	68.5
	Total	**03/23/2011**	**06/30/2012**	**239.5**
Salmon River Subbasin				
Lake Creek	Spring 2011	03/31/2011	06/30/2011	60.5
	Summer 2011	07/01/2011	08/31/2011	61
	Fall 2011	09/01/2011	11/03/2011	60.5
	Spring 2012	03/29/2012	06/30/2012	90.5
	Total	**03/31/2011**	**06/30/2012**	**272.5**
Secesh River	Spring 2011	04/25/2011	06/30/2011	43.5
	Summer 2011	07/01/2011	08/31/2011	59.5
	Fall 2011	09/01/2011	11/2/2011	60
	Spring 2012	04/16/2012	06/30/2012	71.5
	Total	**04/25/2011**	**06/30/2012**	**234.5**
South Fork Salmon River	Spring 2011	03/05/2011	06/30/2011	48.5
	Summer 2011	07/01/2011	08/31/2011	58.0
	Fall 2011	09/01/2011	10/25/2011	45.0
	Spring 2012	03/04/2012	06/30/2012	51.5
	Total	**03/05/2011**	**06/30/2012**	**203.0**
Marsh Creek	Spring 2010	03/19/2011	06/30/2011	103.5
	Summer 2010	07/01/2011	08/31/2011	62
	Fall 2010	09/01/2011	11/02/2011	56
	Spring 2011	03/20/2012	06/30/2012	98.5
	Total	**03/19/2011**	**06/30/2012**	**320.0**

Appendix D. Continued.

Stream	Season and Calendar Year			
Upper Salmon River	Spring 2010	03/19/2011	06/30/2011	79.5
	Summer 2010	07/01/2011	08/31/2011	62
	Fall 2010	09/01/2011	11/02/2011	58
	Spring 2011	03/20/2012	06/30/2012	48
	Total	**03/19/2011**	**06/30/2012**	**247.5**
Pahsimeroi River	Spring 2010	02/25/2011	06/30/2011	98
	Summer 2010	07/01/2011	08/31/2011	60
	Fall 2010	09/01/2011	12/01/2011	84
	Spring 2011	02/28/2012	06/30/2012	102
	Total	**02/25/2011**	**06/30/2012**	**344.0**
Lemhi River	Spring 2010	03/09/2011	06/30/2011	114
	Summer 2010	07/01/2011	08/31/2011	62
	Fall 2010	09/01/2011	11/30/2011	91
	Spring 2011	03/06/2012	06/30/2012	115
	Total	**03/09/2011**	**06/30/2012**	**382.0**
East Fork Salmon River	Spring 2011	03/18/2011	06/30/2011	50
	Summer 2011	07/01/2011	08/31/2011	41
	Fall 2011	09/01/2011	11/14/2011	75
	Spring 2012	03/16/2012	06/30/2012	50
	Total	**03/18/2011**	**06/30/2012**	**216.0**
WF Yankee Fork Salmon River	Spring 2011	04/15/2011	06/30/2011	37
	Summer 2011	07/01/2011	08/31/2011	55
	Fall 2011	09/01/2011	11/11/2011	72
	Spring 2012	04/10/2012	06/30/2012	52
	Total	**04/15/2011**	**06/30/2012**	**216.0**

Appendix E. Inventory of adult and juvenile (parr, presmolt, and smolt) DNA samples collected from ISS sampling sites including number collected and location of the samples. Adults are separated by origin (natural = Nat, general production hatchery = H, and supplementation = Sup). Locations include the Eagle Fish Genetics Laboratory (EFGL), IDFG Nampa Research (NR), Idaho Fishery Resource Office (IFRO), and NPT McCall (NPTM).

Sample Site	Brood Year	Life Stage	Origin	Number Collected	Archive Location
Pahsimeroi River	2002	adult	Sup	142	EFGL
		adult	Nat	264	EFGL
		parr/presmolt	Nat	442	EFGL
		smolt	Nat	692	EFGL
	2003	adult	Sup	435	EFGL
		adult	Nat	325	EFGL
		parr/presmolt	Nat	375	EFGL
		smolt	Nat	511	EFGL
	2004	adult	Sup	281	EFGL
		adult	Nat	200	EFGL
		parr/presmolt	Nat	959	EFGL
		smolt	Nat	476	EFGL
		age 1 precocial	Nat	74	EFGL
	2005	adult	Sup	302	EFGL
		adult	Nat	326	EFGL
		parr/presmolt	Nat	349	EFGL
		age 0 precocial	Nat	74	EFGL
		smolt	Nat	305	EFGL
		age 1 precocial	Nat	106	EFGL
	2006	adult	Sup	76	EFGL
		adult	Nat	97	EFGL
		parr/presmolt	Nat	561	EFGL
		Smolt	Nat	231	EFGL
	2007	adult	Sup	17	EFGL
		adult	Nat	138	EFGL
		parr/presmolt	Nat	453	NR
		smolt	Nat	84	NR
	2008	adult	Nat	224	EFGL
		parr/presmolt	Nat	111	NR
		smolt	Nat	41	NR
	2009	adult	Nat	322	EFGL
		parr/presmolt	Nat	59	NR
		smolt	Nat	19	NR
	2010	adult	Nat	292	NR
		parr/presmolt	Nat	48	NR
	2011	adult	Nat	372	NR
Upper Salmon River	2002	adult	Sup	546	NR
		adult	Nat	794	NR
		parr/presmolt	Nat	765	NR
		smolt	Nat	620	NR
	2003	adult	Sup	371	NR
		adult	Nat	381	NR
		parr/presmolt	Nat	437	NR
		smolt	Nat	850	NR

Appendix E. Continued.

Sample Site	Brood Year	Life Stage	Origin	Number Collected	Archive Location
Upper Salmon River (cont.)	2004	adult	Sup	215	NR
		adult	Nat	473	NR
		parr/presmolt	Nat	597	NR
		smolt	Nat	332	NR
	2005	adult	Sup	159	NR
		adult	Nat	286	NR
		parr/presmolt	Nat	238	NR
		smolt	Nat	188	NR
		precocial	Nat	15	NR
	2006	adult	Sup	99	NR
		adult	Nat	294	NR
		parr/presmolt	Nat	397	NR
		smolt	Nat	123	NR
	2007	adult	Sup	23	NR
		adult	Nat	183	NR
		parr/presmolt	Nat	351	NR
		smolt	Nat	571	NR
	2008	adult	Nat	390	NR
		parr/presmolt	Nat	83	NR
		smolt	Nat	61	NR
	2009	adult	Nat	438	NR
		parr/presmolt	Nat	68	NR
		smolt	Nat	54	NR
	2010	adult	Nat	681	NR
		parr/presmolt	Nat	69	NR
		smolt	Nat		NR
	2011	adult	Nat	582	EFGL
Crooked Fork Creek	2004	smolt	Nat	52	NR
	2005	adult	Nat	27	NR
		parr/presmolt	Nat	251	NR
		smolt	Nat	41	NR
	2006	adult	Nat	26	NR
		parr/presmolt	Nat	287	NR
		smolt	Nat	84	NR
	2007	adult	Nat	36	NR
		parr/presmolt	Nat	21	NR
		smolt	Nat	25	NR
	2008	adult	Nat	41	NR
		parr/presmolt	Nat	57	NR
		smolt	Nat	85	NR
	2009	adult	Nat	20	NR
		parr/presmolt	Nat	28	NR
		smolt	Nat	20	NR
	2010	adult	Nat	23	NR
		parr/presmolt	Nat	22	NR
		smolt	Nat		NR
	2011	adult	Nat	27	NR
Colt Killed Creek	2004	smolt	Nat	25	NR
	2005	parr/presmolt	Nat	37	NR
		smolt	Nat	3	NR
	2006	parr/presmolt	Nat	36	NR
		smolt	Nat	42	NR

Appendix E. Continued.

Sample Site	Brood Year	Life Stage	Origin	Number Collected	Archive Location
Colt Killed Creek (Cont.)	2007	parr/presmolt	Nat	73	NR
		smolt	Nat	27	NR
	2008	parr/presmolt	Nat	55	NR
		smolt	Nat	40	NR
	2009	parr/presmolt	Nat	42	NR
		smolt	Nat	49	NR
	2010	parr/presmolt	Nat	43	NR
		smolt	Nat		NR
South Fork Salmon River	2005	adult	Sup	132	NR
		adult	Nat	251	NR
		parr/presmolt	Nat	1,885	NR
		smolt	Nat	444	NR
	2006	adult	Sup[i]	75	NR
		adult	Sup	245	NR
		adult	Nat	259	NR
		parr/presmolt	Nat	576	NR
		smolt	Nat	117	NR
		yearling	Nat	71	NR
	2007	adult	Sup	60	NR
		adult	Nat	276	NR
		parr/presmolt	Nat	340	NR
		Smolt	Nat	105	NR
		Yearling	Nat	9	NR
	2008	Adult	Hat[ii]	5	NR
		Adult	Nat	580	NR
		parr/presmolt	Nat	102	NR
		smolt	Nat	42	NR
		yearling	Nat	13	NR
	2009	Adult	Hat[ii]	10	NR
		Adult	Nat	539	NR
		parr/presmolt	Nat	111	NR
		smolt	Nat	43	NR
		Yearling	Nat	36	NR
	2010	adult	Nat	1338	NR
		parr/presmolt	Nat	100	NR
	2011	adult	Nat	690	NR
Marsh Creek	2004	smolt	Nat	61	NR
	2005	parr/presmolt	Nat	496	NR
		smolt	Nat	77	NR
	2006	parr/presmolt	Nat	43	NR
		smolt	Nat	37	NR
		age 1 precocial	Nat	95	NR
	2007	parr/presmolt	Nat	34	NR
		smolt	Nat	44	NR
		age 1 precocial	Nat	51	NR
	2008	parr/presmolt	Nat	63	NR
		smolt	Nat	54	NR
	2009	parr/presmolt	Nat	53	NR
		smolt	Nat	21	NR

Appendix E. Continued.

Sample Site	Brood Year	Life Stage	Origin	Number Collected	Archive Location
Marsh Creek (Cont.)	2010	parr/presmolt	Nat	135	NR
		Smolt	Nat		NR
Lemhi River	2004	Smolt	Nat	100	NR
	2005	parr/presmolt	Nat	100	NR
	2005	Smolt	Nat	81	NR
	2006	parr/presmolt	Nat	99	NR
	2007	parr/presmolt	Nat	98	NR
	2007	Smolt	Nat	16	NR
	2008	parr/presmolt	Nat	51	NR
		Smolt	Nat	13	NR
	2009	parr/presmolt	Nat	67	NR
		Smolt	Nat	98	NR
American River					
	Unk	Juvenile	Nat	55	NR
	Unk	Juvenile	Nat	100	NR
	2005	Juvenile	Nat	100	NR
	2006	Juvenile	Nat	44	NR
	2007	Juvenile	Nat	150	NR
	2008	Juvenile	Nat	155	NR
	2009	Juvenile	Nat	94	NR
	2010	Juvenile	Nat	52	NR
Crooked River					
	Unk	Juvenile	Nat	105	NR
	Unk	Juvenile	Nat	50	NR
	2005	Juvenile	Nat	100	NR
	2006	Juvenile	Nat	18	NR
	2007	Juvenile	Nat	4	NR
	2008	Juvenile	Nat	123	NR
	2009	Juvenile	Nat	148	CRITFC
	2010	Juvenile	Nat	65	CRITFC
Red River					
	Unk	Juvenile	Nat	102	NR
	Unk	Juvenile	Nat	50	NR
	2005	Juvenile	Nat	100	NR
	2006	Juvenile	Nat	47	NR
	2007	Juvenile	Nat	173	NR
	2008	Juvenile	Nat	178	NR
	2009	Juvenile	Nat	103	NR
	2010	Juvenile	Nat	53	NR
Clear Creek	2004	adult	Sup	57	IFRO
			Nat	61	IFRO
	2005	adult	Sup	8	IFRO
			Nat	8	IFRO
	2006	adult	Sup	13	IFRO
			Nat	16	IFRO
	2006	smolt	Nat	39	IFRO
	2007	adult	Sup	1	IFRO
			Nat	18	IFRO
	2008	adult	Nat	7	IFRO
	2009	adult	Nat		IFRO
	2010	adult	Nat	7	IFRO

Appendix E. Continued.

Sample Site	Brood Year	Life Stage	Origin	Number Collected	Archive Location
Clear Creek (Cont.)	2011	adult	H	50	IFRO
	2011	adult	Nat	11	IFRO
Fishing Creek	2002	adult	H	1	NPTM
	2003	parr	Nat	60	NPTM
	2003	adult	Nat	2	NPTM
	2004	adult	Nat	3	NPTM
	2005	parr	Nat	80	NPTM
	2006	adult	Nat	1	NPTM
	2007	adult	Nat	1	NPTM
	2008	parr	Nat	100	NPTM
	2008	adult	Nat	11	NPTM
	2008	adult	H	6	NPTM
	2009	adult	H	1	NPTM
	2009	juvenile	Nat	60	NPTM
	2011	adult	Nat	1	NPTM
	2011	adult	H	2	NPTM
Lake Creek	2002	juvenile			
	2002	adult	H	7	NPTM
	2002	adult	Nat	144	NPTM
	2003	juvenile			NPTM
	2003	adult	Nat	229	NPTM
	2004	juvenile			NPTM
	2004	adult	H	8	NPTM
	2004	adult	Nat	168	NPTM
	2004	adult	Unk	3	NPTM
	2005	juvenile	Nat	892	NPTM
	2005	adult	Nat	75	NPTM
	2006	juvenile	Nat	800	NPTM
	2006	adult	H	2	NPTM
	2006	adult	Nat	26	NPTM
	2007	juvenile	Nat	900	NPTM
	2007	adult	Nat	33	NPTM
	2008	juvenile	Nat	865	NPTM
	2008	adult	Nat	123	NPTM
	2008	adult	H	5	NPTM
	2009	adult	H	5	NPTM
	2009	adult	Nat	110	NPTM
	2009	juvenile	Nat	100	NPTM
	2011	adult	Nat	67	NPTM
Legendary Bear Creek	2002	parr	Nat	60	NPTM
	2002	adult	H	12	NPTM
	2002	adult	Nat	14	NPTM
	2002	adult	Unk	1	NPTM
	2003	parr	Nat	60	NPTM
	2003	adult	H	2	NPTM
	2003	adult	Nat	3	NPTM
	2004	parr	Nat	80	NPTM
	2004	adult	H	10	NPTM
	2004	adult	Sup	8	NPTM
	2004	adult	Nat	7	NPTM
	2004	adult	Unk	1	NPTM

Appendix E. Continued.

Sample Site	Brood Year	Life Stage	Origin	Number Collected	Archive Location
Legendary Bear (Cont.)	2005	parr	Nat	80	NPTM
	2005	adult	Nat	1	NPTM
	2006	parr	Nat	60	NPTM
	2006	adult	H	6	NPTM
	2006	adult	Nat	4	NPTM
	2008	parr	Nat	100	NPTM
	2008	adult	Nat	14	NPTM
	2008	adult	H	19	NPTM
	2008	adult	Unk	1	NPTM
	2009	adult	H	12	NPTM
	2009	juvenile	Nat	60	NPTM
	2011	adult	Nat	1	NPTM
	2011	adult	H	5	NPTM
Secesh River	2009	adult	Nat	4	NPTM
	2002	adult	H	16	NPTM
	2002	adult	Sup	2	NPTM
	2002	adult	Nat	130	NPTM
	2003	adult	H	3	NPTM
	2003	adult	Nat	242	NPTM
	2004	adult	H	2	NPTM
	2004	adult	Nat	111	NPTM
	2004	adult	Unk	1	NPTM
	2005	juvenile	Nat	892	NPTM
	2005	adult	H	1	NPTM
	2005	adult	Nat	76	NPTM
	2006	juvenile	Nat	864	NPTM
	2006	adult	H	2	NPTM
	2006	adult	Nat	34	NPTM
	2006	adult	Unk	1	NPTM
	2007	juvenile	Nat	900	NPTM
	2007	adult	H	8	NPTM
	2007	adult	Nat	47	NPTM
	2008	juvenile	Nat	887	NPTM
	2008	adult	Nat	183	NPTM
	2008	adult	H	19	NPTM
	2008	adult	Unk	1	NPTM
	2009	adult	H	5	NPTM
	2009	adult	Nat	155	NPTM
	2009	juvenile	Nat	100	NPTM
	2011	adult	Nat	207	NPTM
	2011	adult	H	13	NPTM
	2011	adult	Unk	1	NPTM
Slate Creek	2002	adult	H	2	NPTM
	2002	adult	Nat	17	NPTM
	2002	adult	Unk	1	NPTM
	2003	adult	H	1	NPTM
	2003	adult	Nat	1	NPTM
	2008	adult	Nat	4	NPTM
	2009	adult	H	1	NPTM
	2011	adult	H	1	NPTM

Appendix E. Continued.

Sample Site	Brood Year	Life Stage	Origin	Number Collected	Archive Location
Pete King Creek	2011	Adult	Nat	1	IFRO

Appendix F. Table 1. Stream sections and lengths (km) surveyed for Chinook salmon redds and carcasses for viable salmonid population (VSP) monitoring in the upper Marsh Creek spawning population. These reaches include all likely spawning habitats in these streams. Data from these reaches must be combined with Idaho Supplementation Studies surveys in Marsh and Knapp creeks to summarize the entire spawning population.

Stream	Upper boundary	Lower boundary	km
Cape Horn Creek	Banner Creek	Mouth	6.61
Banner Creek	Highway 21 culvert at mile post 107	Mouth	4.40
Marsh Creek	Cape Horn Creek mouth	Screw Trap at Lola Creek campground	1.75
Beaver Creek	Bridge 0.63 km downstream of Prospect Creek	Mouth	15.12
Winnemucca Creek	500 meters upstream of mouth	Mouth	0.50

Appendix F. Table 2. Summary of Chinook salmon redd count data associated with viable salmonid population monitoring activities in the upper Marsh Creek spawning population in 2012. These data must be combined with Idaho Supplementation Studies redd counts for Marsh and Knapp creeks to summarize the entire spawning population.

Stream	Survey length (km)	Redds	Redds per km	Passes	Last pass	Survey method
Marsh Creek	1.75	4	2.28	2	09/04/2012	Ground
Cape Horn Creek	6.61	53	8.01	4	09/05/2012	Ground
Banner Creek	4.40	10	2.27	3	09/05/2012	Ground
Beaver Creek	15.12	21	1.39	1	09/05/2012	Aerial[a]
Winnemucca Creek	0.50	0	0	1	09/05/2012	Aerial[a]

[a] The Halstead Complex fire prevented access by ground counters. Aerial counts provided by R. Thurow (USFS, Rocky Mountain Research Station) Project Number 1999-020-00.

Appendix F. Table 3. Number, origin (GP = general production hatchery), and sex of adult Chinook salmon carcasses collected during 2012 spawning ground surveys associated with viable salmonid population monitoring activities in the upper Marsh Creek spawning population. These data must be combined with Idaho Supplementation Studies carcass collections for Marsh and Knapp creeks to summarize the entire spawning population. Streams not walked in 2012 are designated ND.

Stream	Sex	Unknown	Natural	General production
Marsh Creek	Male	0	4	0
	Female	0	1	0
	Unknown	0	0	0
	Total	**0**	**5**	**0**
Cape Horn Creek	Male	0	11	0
	Female	0	13	1
	Unknown	0	1	0
	Total	**0**	**25**	**1**
Banner Creek	Male	0	0	0
	Female	0	0	0
	Unknown	0	0	0
	Total	**0**	**0**	**0**
Beaver Creek[a]	Male	ND	ND	ND
	Female	ND	ND	ND
	Unknown	ND	ND	ND
	Total	**ND**	**ND**	**ND**

[a] Beaver Creek was not walked in 2012 due to the Halstead Complex Fire.

Appendix F. Table 4. Juvenile trap operations to collect brood year 2010 spring/summer Chinook salmon in the upper Marsh Creek spawning population for viable salmonid population (VSP) monitoring. The spring trapping season extends from trap deployment in the spring to June 30. The summer season extends from July 1 to August 31. The fall season runs from September 1 to trap removal.

Stream	Season and Calendar Year	Start Date	End Date	Total Days Trapped
Marsh Creek VSP	Spring 2011	03/20/2011	06/30/2011	82.5
	Summer 2011	07/01/2011	08/31/2011	62
	Fall 2011	09/01/2011	11/02/2011	57
	Spring 2012	03/20/2012	06/30/2012	99
	Total	**03/20/2011**	**06/30/2012**	**300.5**

Appendix F. Table 5. Seasonal and overall migration estimates of brood year 2010 juvenile Chinook salmon and corresponding lower (LCI) and upper (UCI) 95% confidence intervals from the upper Marsh Creek spawning population. Estimates are based on the total catch, recapture rate of tagged fish, and the estimated trap efficiency.

Stream	Life Stage	Catch	Estimate	LCI	UCI
Marsh Creek VSP	Fry	885	NE	NE	NE
	Parr	10,785	262,536	199,831	350,506
	Presmolt	9,646	88,743	78,832	100,221
	Smolt	770	14,803	10,781	20,524
	Brood Year Total	**32,871**	**366,082**	**303,708**	**465,501**

Appendix F. Table 6. Estimated survival (proportion) and standard error (SE) to Lower Granite Dam for different life stages of naturally produced brood year 2010 juvenile Chinook salmon PIT tagged from the upper Marsh Creek spawning population for viable salmonid population (VSP) monitoring. Data represent an aggregate survival for juveniles from Marsh, Knapp, Cape Horn, Banner and Beaver creeks. Survival estimates were computed using the SURPH2 Model (Lady et al. 2001).

Stream	Life stage	Number tagged	Survival (SE)
Marsh Creek VSP	Parr	2,658	0.1494 (0.01)
	Presmolt	2,200	0.1849 (0.01)
	Smolt	848	0.2803 (0.03)

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